THE

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1901 Edition

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GLYNN v. ATHERTON AND OTHERS.

UNDER the guise of an action at law, a Liverpool jury has received, at considerable length, a lesson in what a well-known essayist calls "the art of putting things." In January, 1899, a cycle manufacturing company, known as R. F. Hall & Co., Limited, passed into the hands of a liquidator, who sought a purchaser for the business and found one in Mr. J. B. Atherton. In February, 1899, an agreement was entered into whereby the business was transferred for the sum of £55,000, which Mr. Hall informed the Court which had to assent to the transfer, was a good and adequate price considering the circumstances of the cycle trade. In our issue of April 28th, 1899 (p. 694), we noticed the prospectus of the British Electric Works Company, Limited, which was formed to purchase for £142,000 (payable as to £40,000 in ordinary shares, £45,000 in cash or ordinary shares, or partly in both, and the balance in cash) the establishment of an electrical manufactory, freehold land, buildings, and plant, plus certain leasehold property and stock (£5,000), valued at £110,888, thus leaving £31,112 as the purchase price of the remaining assets—namely, certain patents, goodwill, &c. The company bought from Mr. Atherton for £142,000 (of which £102,000 was paid in cash) the premises and property which Mr. Atherton acquired from the liquidator of the cycle company for £55,000, and it was alleged by counsel for the plaintiff, and not seriously contested by the defendant, that in the interval between purchase and sale nothing had been spent in improving the works or adding to their value in any way. In his evidence the vendor said that the applications of the public amounted to the full sum for which subscription was invited, and that the directors were consequently bound to give him the optional £45,000 in cash instead of shares. In cross-examination it was elicited that, in reality, the total application was 16,900 shares short, and the vendor applied for them through nominees. In his examination he stated that he had never sold a single share, but in cross-examination it was explained that this referred to vendors' shares. In addition to the share capital there was an issue of £50,000 debentures, 10 per cent. commission (half in cash, half in shares) being paid to intermediaries who negotiated the transaction, under circumstances calling for strong comments from Mr. Justice Bucknill. The British Electric Works Company went into liquidation, and in June last its assets were disposed of for £66,000. The action was that of a shareholder claiming the return of his investment, on the ground of misrepresentation in the prospectus.

In his summing up of the case his Lordship placed the issue before the jury very fairly and very clearly:—The plaintiff said defendants were buying a moribund cycle business and premises, but defendants said, not at all; what they were buying was the premises, plant, machinery, not for the purpose of carrying on a cycle business, but for the purpose of carrying on a distinctly new business, to

be commenced, created, and brought together by their own energy; and after dealing fully with the evidence, his Lordship submitted to the jury a series of questions, printed in detail in our "Notes" columns last week. In replying to these questions, the jury found that in its general tenour the prospectus was untruthful, false, and fraudulent; that the statements which were complained of were untrue, and that the plaintiff was induced to apply for shares by such statements. They found that the defendants had not reasonable grounds to believe, and did not in fact believe, the statements to be true; that they made them fraudulently, and so far as J. B. Atherton and Jacob Atherton were concerned, they made them wilfully. There were contracts that were material to be disclosed to intending applicants for shares, and the plaintiff had suffered loss to the extent of £950, which was the amount of his subscription, less a bonus of 2s. each on his preference shares.

The defendants in this case, in studying "the art of putting things" in a prospectus, had not considered sufficiently the difference between "representation and misrepresentation." In the opinion of the jury a cycle factory is misrepresented when it is described as an electrical works, and, notwithstanding the expert evidence called for the defence, the soundness of the jury's judgment must be generally admitted.

It is unquestionably true that some of the machinery adapted to the manufacture of cycles is equally adapted to the manufacture of some electrical apparatus. But can a factory be said to be "equipped" for electrical manufactures when it is innocent of any patterns or tools for any electrical apparatus, and lacks the experienced hands to make or use them? The view of the defence, that a new business was being started, had certainly some support from the prospectus, but for the margin between the valuation and purchase price. This gap of £31,000 odd, could only be filled by "goodwill," and goodwill is only applicable to a continued business.

There was absolute unanimity amongst the directors and co-defendants in regarding the company as a perfectly *bonâ-fide* undertaking into which they had embarked their own money and advised their friends also to invest. The advice to the friends need not necessarily be conclusive evidence, but no suggestion was made that the directors did not qualify for their directorships with their own money, or regard the investment as one likely to be productive. With one exception the directors were already interested in electrical companies or undertakings. They had some influence in the electrical world, and we see no reason to doubt that they expected the exercise of their influence to turn even an over-capitalised company into a commercial success. We had occasion in discussing Mr. Higginbottom's retirement from the Electrical Committee of the Manchester Corporation to allude to his connection with the British Electric Works, and the evidence in the recent trial confirms the view we then expressed. To Mr. Jacob Atherton the purchase and sale of the property was a simple matter of business. He thought his brother had never made a better bargain than when he bought the property for £55,000, which remark prompted Mr. Asquith to ask whether he did not think his brother made a still better bargain when he sold the property for £142,000. On this point the judge said that he thought it would be agreed that Mr. J. B. Atherton was eminently fitted to buy the business, and he should think that it had been shown that he was eminently fitted to sell it. He did not mean to say anything to hurt Mr. Atherton's feelings, because a man was entitled to buy a thing as cheaply as possible, and sell it as dearly as he could as long as everything was honest. His Lordship added, what all will agree with, that it would be a sad day for this country if a man was condemned for making a good bargain. These remarks were well calculated to remove from the minds of the jury any prejudice that might arise from the disproportionate sale and purchase prices. The result, however, may tend to emphasise the difference between a bargain made and carried out between those who are acquainted with all the facts, and a bargain where the acquaintance with the facts is limited to one side. The satisfaction which may justifiably be felt at completing a profitable business transaction on equal terms is not permissible when the transaction is carried out between a promoter and his personal friends acting as directors on behalf of unknown investors. On the one hand is complete knowledge; on the other hand is just so much knowledge as the prospectus gives. If the prospectus misrepresents some facts, and altogether suppresses others, the investor must be at a disadvantage, and it is fortunate that the law can be invoked on his behalf. It is doubtful if anyone reading our remarks on the British Electric Works Company's prospectus would have invested. If he did so, he would have realised the speculative nature of the investment, but if all the facts as now known had been then disclosed, it is not reasonable to suppose that the capital would have been subscribed. If that be so, the directors cannot be said to have done their duty, and the verdict of the jury, though a hard, is none the less a just, retribution for their negligence, if for nothing worse.

Standard Railway Traction.

We again notice in the editorial pages of an esteemed contemporary, a disposition to defend the position assumed in a previous issue, namely, that Parliament should frame laws to standardise a system of railway electric traction, in order to prevent the possible diversity of systems throughout the United Kingdom. Our contemporary states that it was intended to confine its statements to the distributing system from which the locomotive or locomotive cars receive their energy, while in our article we assumed that an entire system, including generating apparatus, was meant.

Our contemporary is mistaken; our criticism was intended to apply only to the principle involved, and did not refer to the power generating station, nor to the line-transmission and sub-stations. The whole question of Parliamentary interference, referred to in our article, turned on the point of line-distribution.

We take issue squarely with our contemporary on this question of Parliamentary interference, and on nothing else. Our claim is that we have had too much legislation on electrical undertakings already, and that this legislation is largely responsible for the backward state of the country in this important industry. We believe that our engineers and railway managers are, as a class, clear-headed men, and that under their guidance our railways can, and will, work out their own salvation on this subject of electrical distributing systems, just as they have on the subject of track gauge and other important matters involved in the operation of railways. Our engineering societies have been formed largely with the object of freely discussing just such topics, and for the establishment of standards, where possible. We doubt the advisability of carrying such discussion into the Committee Rooms of the Houses of Parliament.

General legislation for the protection of the lives and property of the public is essential; specific legislation restricting the development of an industry to specified paths, and thus limiting individual effort and enterprise, is, in our opinion, unnecessary, harmful and wrong in principle, especially so for a country which depends very largely upon its foreign trade for its existence among nations. Mistakes must be made, and capital, in a sense, wasted, in bringing an industry to a state of perfection, but this wasted capital should be returnable many times over by trade secured through taking the initiative in its development.

We trust that we have stated our views clearly, for, while the subject is relatively of small importance, yet the principle involved is of great moment to this country, and especially so at a time which we believe to be a critical one in its history.

THE ELECTRIC LIGHTING OF LUTON.

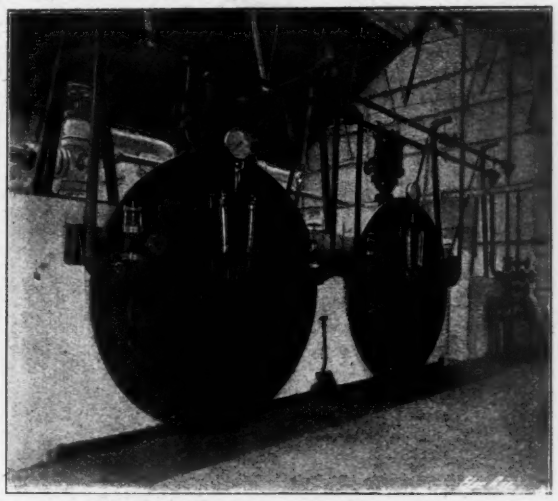
In the year 1895 the Borough Council of Luton obtained a provisional order for electric lighting, and in the following year the Electric Lighting Committee conferred with Mr. Albion T. Snell, consulting engineer, and a Sub-Committee was appointed, which visited a number of electricity works.

Front View of Works.

In April, 1897, Mr. Snell was requested to report fully on the lighting of the town, having regard to the introduction of a dust destructor, and also to the adoption of electric tramways at a future date. His report was finally approved by the Committee, and confirmed by the Town Council in June, 1898, and in the following month he was formally instructed to prepare specifications and plans.

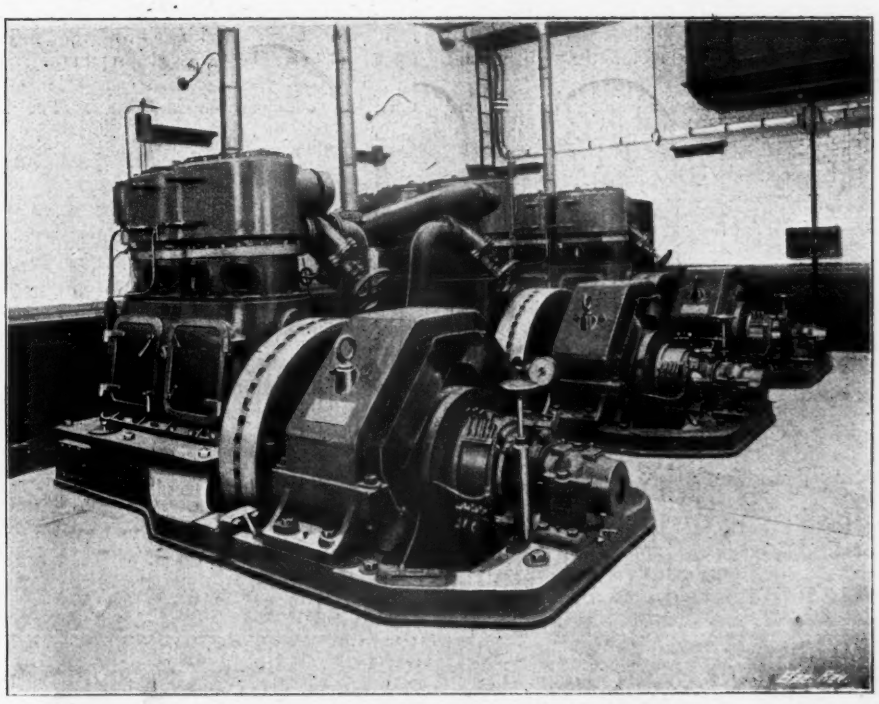
Tenders for plant and buildings amounting to £26,000 were accepted by the Corporation provisionally in 1899, and application was made to the Local Government Board for a loan of £27,000. This received sanction in the following year, and the work was commenced in the summer of 1900. The station is conveniently situated on the old vicarage site, adjacent to St. Mary's Parish Church, and near the River Lea.

The provisional plans of the buildings were prepared by the consulting engineer, and the buildings were erected by the borough surveyor, Mr. A. J. L. Evans, A.M.I.C.E., who prepared the necessary designs and acted as architect. The engine and boiler rooms are parallel to each other and permit of ample extension towards the river. The first



View of Boiler House.

plant is designed so as to be practically self-contained and independent of future extensions, so that in the event of accident, from fire or otherwise, the first plant of about 1,000 H.P. can be separated from the larger units which will follow in due course. The floor of the engine room is laid with slabs of artificial stone, and the walls are lined with glazed brick to the underneath side of the girders supporting a six-ton traveller. Both engine room and boiler house have skylights throughout their length, with ventilators on each side.

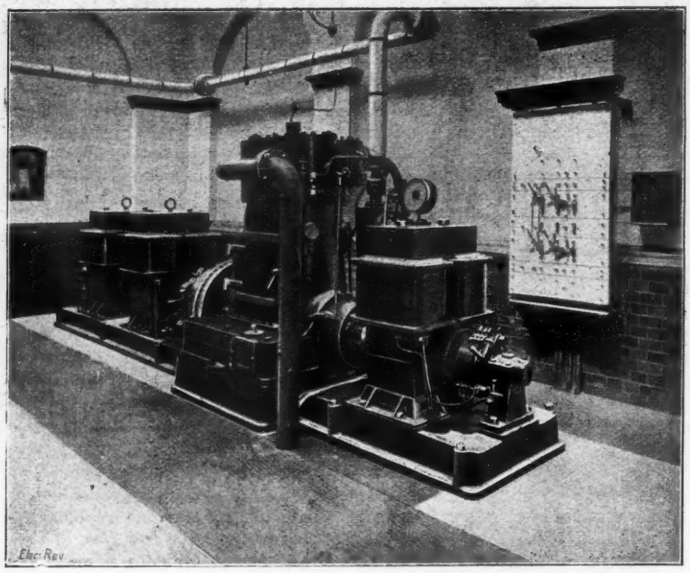


General View of Steam Dynamos.

The chimney shaft is octagonal, with a square base. It is 120 ft. high above ground line, with a minimum internal area of 60 sq. ft. The fire brick lining is carried up for about 40 ft. The capacity of the shaft with natural draught is fully equal to 2,000 H.P.

Two Lancashire boilers by Messrs. Tinkers, Limited, have so far been fixed, each being 8 ft. diameter by 30 ft. long, fitted with two internal furnaces 3 ft. 3 in. in diameter,

which are reduced to 2 ft. 9 in. at the back of the boiler. There are no cross tubes. The boilers are built for a working pressure of 160 lbs. per sq. in., and have been tested hydraulically to a pressure of 280 lbs. per sq. in.



Steam Balancer and Charging Dynamo.

There is a main vertical steam ring 8 in. in diameter, with 7 in. branches to the boilers in the lower member, and branch pipes to the engines from the top member. A Musgrave superheater is fitted to each boiler. Space is provided for a third boiler.

There is a Green's economiser of 240 tubes, capable of raising 15,000 lbs. of water per hour from 60° F., to 212° F. Space is provided for 120 additional tubes. The scrapers are worked by an electric motor through worm gearing.

The coal bunkers are in line with the boilers, and open on to the firing platform. In the first instance the boilers will be hand fired, but arrangements are made for mechanically handling the coal in the future.

The main exhaust pipe is 12 in. in diameter, and is laid in a culvert under the engine room floor. The exhaust steam is passed through a Wright-Berryman surface condenser capable of condensing 10,000 lbs. of steam per hour with a vacuum of 25 in. of mercury; or it can be taken direct to atmosphere through a Blake & Knowles automatic valve. The air-pump is of the Edwards type with two cylinders coupled to a compound engine. The circulating water is supplied from a concrete-lined cooling pond adjacent to the River Lea, so designed that part of the river can be deflected through it. The pipes are so arranged as to siphon through a steam-driven centrifugal pump, the maximum capacity being 40,000 gallons per hour. Ultimately it is intended to erect a cooling tower above the pond. The auxiliary steam service is 2 in. in diameter.

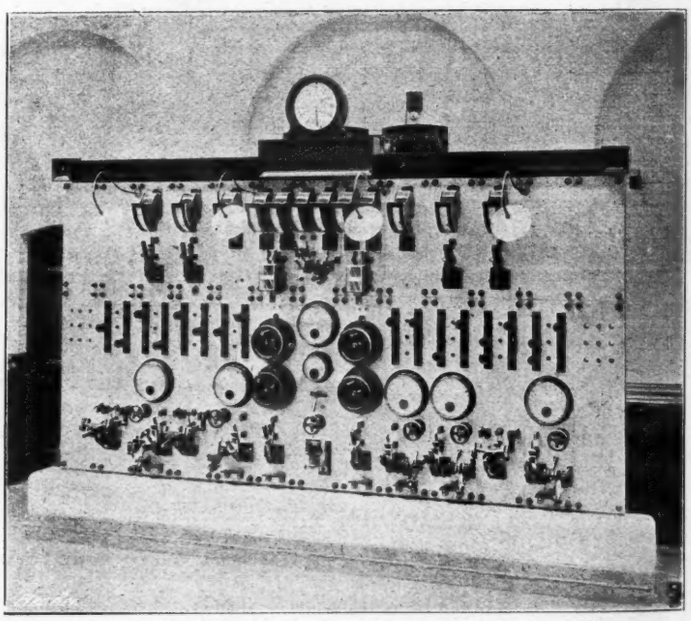
The feed-water service comprises two steam Pearn fly-wheel pumps, each of 10,000 lbs. per hour capacity, and a steam injector of equal capacity. There is a cold storage tank of 6,000 gallons capacity, and a Tyacke water softening plant capable of treating 250 gallons per hour. There are the usual duplicate services for feeding the boilers with condensed water from the hot well, or from the cooling pond, or from the cold storage tank, either through the economiser or direct to the boilers through a small feed-water heater. The feed-water is measured by a Kennedy meter.

The whole of the pipe and feed work has been carried out by Messrs. Babcock & Wilcox, Limited.

The generating sets comprise three 85-KW. steam dynamos by Messrs. W. H. Allen, Sons & Co., Limited, running at 390 revolutions per minute, and a 42-KW. steam balancer by the same makers running at 480 revolutions. The two balancing dynamos are connected to the engine through a coupling, so that they can be disconnected and run as a motor balancer when desired. On the other side of the engine is permanently coupled a 16-KW. dynamo used for charging the regulating cells. Space is provided for an extension set of about 250 KW.

The large dynamos have four poles and carbon brushes, and are designed to give an output of 170 amps. each at 500 to 550 volts when running at normal speed, and to endure a 15 per cent. overload for three hours without undue heating. They are shunt-wound, with regulating resistance in the shunts.

The main switchboard, by Messrs. Nalder Bros. and Thompson, is in Sicilian marble on an iron frame surmounted by a clock, and consists of five panels for dynamos and five for feeders, with battery and balancer regulating panels in the centre. On the lower panel in the centre are mounted the ammeter, automatic cut-out and resistance for connecting the middle wire to earth. At the back of the board are three horizontal bus bars. In the front are vertical bus bars so arranged that any machine can be coupled to either of the horizontal bus bars. Each dynamo is provided on one pole with an automatic maximum and minimum cut-out, and on the other pole with a main switch interlocking with the field switch; each main set can be excited separately or off the bus bar, but the field circuit cannot be closed or opened until the main switch is opened. The instruments are



Main Switchboard.

chiefly Weston, Kelvin and Nalder Bros. & Thompson's edgewise permanent-magnet moving-coil type.

There are two batteries, each of 140 cells, of the Chloride

type. Each battery is capable of giving 160 amps. for two hours, 100 amps. for 4 hours, or 70 amps. for seven hours. The main batteries are charged across the terminals of the bus bars. The regulating cells are in the centre on either side of the neutral wire, and are charged by the dynamo coupled to the steam balancer already referred to.

The whole of the street cables were supplied and laid by Messrs. Callender & Co. They are insulated with vulcanised bitumen, laid on the solid system in wooden troughs filled with bitumen. So far two main feeders are laid, one of 0·3 × 0·3 × 0·3 sq. in. section to the nearest part of the distributing system, and the other 0·2 × 0·2 sq. in. on the outers only, to a point near the Town Hall. The distributing mains in the heaviest section are 0·15 × 0·1 × 0·15 sq. in. but generally are 0·075 × 0·05 × 0·075 sq. in. Two pairs of twin pilot wires are brought from each of the feeding points to the station.

A large number of street boxes have been laid, in all of which the poles are in separate iron boxes, so that each main can be disconnected without risk of a short circuit, or injury to the workmen.

Ten public arc lamps have so far been erected and are coupled in series off the outers, a connection being made between the 5th and 6th lamp to the middle wire through a switch, so that five lamps can be switched off without interfering with the other five. The lamps are Crompton's P. 20 single carbon long type, and each post is fitted with an Edmunds automatic cut-out and compensating resistance. They are controlled from the station.

The arc lamp-posts were specially designed for Luton, and are particularly handsome. The centre of the arc is approximately 23 ft. from the ground. Two 32-c.p. incandescent lamps are to be used after midnight, when the arcs will be switched off.

The demand for current, in spite of the unfavourable time of the year, is considerable, and approximately 2,000 lamps of 8 c.p. are either connected or about to be connected to the mains. The Corporation is supplying energy at 6d. for the first 400 hours of maximum demand, and 3d. per unit afterwards for lighting, the price for power being 6d., and 1½d. per unit, and for heating, a uniform rate of 1½d. per unit. This preferential rate for heating has been decided on by the Corporation in order to encourage electric heating of the various factories.

Wright's demand indicators and Aron wattmeters are used at present.

The following is the list of chief contractors :—

Boilers and economisers	Tinkers, Limited.
Engines and dynamos	W. H. Allen, Son & Co, Ltd.
Pipe work, feed services and water-softening plant...	Babcock & Wilcox, Limited.
Main switchboard and instruments	Nalder Bros. & Thompson.
Condensing plant	J. Wright & Co., Limited.
Street mains and public arc lighting	Callender's Cable and Construction Company, Ltd.
Meters	The General Electric Co., Ltd.
Demand indicators	Reason Manufacturing Co.
Buildings	Nevillé Bros.

Mr. Albion T. Snell was represented during the progress of the works by Mr. W. H. Cooke, A.M.I.E.E., who was appointed borough electrical engineer on June 1st last.

HIGHFIELD-CATER SYSTEM OF UNDERGROUND MAINS.

A novel system of electrical underground cables, patented jointly by Mr. J. S. Highfield and Mr. J. McI. Cater, is now undergoing a practical trial at St. Helens, where an experimental section of cable about a quarter of a mile in length has been laid, and forms part of the network of lighting cables belonging to the Corporation. The three-wire continuous current system of distribution is now employed there, with 230 volts between the middle and outer conductors, and the sectional area of the copper used is ·2, ·1 and ·2 sq. in. This cable has been laid only a short time, but it is giving every satisfaction, and the laying of a further length is under consideration. The following are some of the points claimed for the system :—Small space occupied in the ground ; no surface drawing-in boxes required ; cheapness and rapidity in making house connections ; suitability for distributing electrical energy in a densely populated district, where conductors of large sectional area are necessary ; thorough protection of conductors from all kinds of mechanical damage ; for polyphase systems of distribution a perfectly symmetrical system of conductors is provided ; only a small number of men are required to lay the cable, and these are continuously engaged. With regard to the cost of the cable as compared with that of standard cables of the present day, very careful estimates have shown that when from 15 to 20 per cent. of the actual cost of manufacture has been added by way of standing charges and profit, the cable may be placed upon the market at the same price as ordinary lead-covered cables in porcelain ducts having conductors of equal sectional area. The operations involved in the manufacture of the cable are extremely simple, amounting to little more than the assembling of the several parts.

The cable, as laid at St. Helens, consists of wrought-iron pipes 21 ft. in length, the bore being 3 in. in diameter throughout. The external diameter is about 3½ in., except at the extreme ends, where it is enlarged and screwed for a distance of about 2 in., the diameter at the bottom of the threads being somewhat greater than the external diameter of the pipe ; this allows of the jointing socket being screwed over the pipe whilst the jointing of the copper conductors is being effected (see fig. on page 298).

These conductors, of which there are three, each having a sectional area of ·2 sq. in., project from each end of the pipe for a distance of about 4½ in., and are sent out from the shops with their ends ready tinned, and with a tongue soldered into the grooves at one end.

The wood insulating strips, which are the same length as the pipes, are boiled in a heavy wax, and after each individual length of cable has been assembled, hot wax is forced into the interstices under pressure. The insulation of the length is subsequently tested with an alternating current at a pressure of 2,500 volts for a period of a quarter of an hour, and also with the usual direct current tests for cables of a similar class. Cast-iron caps are then screwed on to each length of pipe to prevent damage during transit from the works to the place of installation.

In laying, the jointer first removes the cap and screws over the end one of the wrought-iron jointing sockets ; the threads disengaging after the first 2 in. admit of the socket being pushed up the pipe clear of the joint.

The second length is then laid in position, with its cap removed, and with its conductors inserted into the copper sleeves on the ends of the conductors of the first length. Heat is applied, melting the tinning, which, upon cooling, unites the conductors in the adjoining lengths. Wood insulating strips are then placed in position round the conductors, and the jointing socket is screwed back into position, making a stiff and water-tight joint. Molten wax is poured into the joint through an orifice in the socket, which is subsequently plugged.

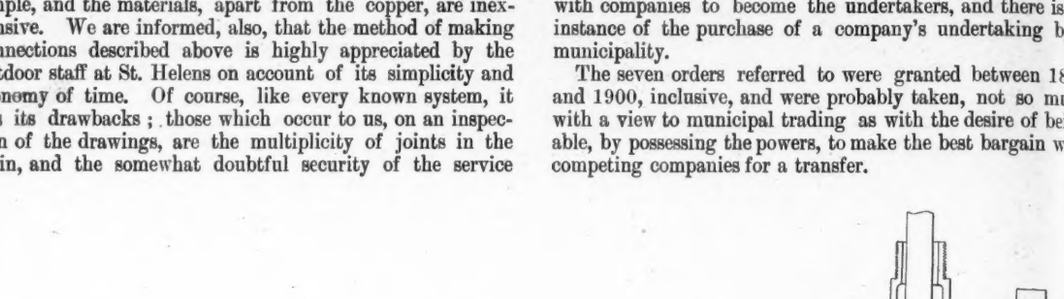
For the house connections each length of pipe is screwed and plugged opposite the middle and an outer conductor before it leaves the factory, so that no drilling is required after the cable has been laid in the street. This admits of a house connection being very quickly and cheaply effected ; and house services may be as readily effected upon conductors of a very large sectional area as upon those of small size.

In the case of a town in which the complete installation is laid on the above system, it is proposed to keep the pipes under a few inches of air pressure, using desiccated air.

When it is desired to make a connection to any one of the conductors, the plug referred to above is removed, and a connecting piece, having its end split and a wedge inserted in the split, is driven in ; the wedge being thus forced up the split, expands the sides of the connecting piece so as to make them fit and hold firmly in the dove-tail. Around the stem of the branch a wooden sleeve is put on in halves. A conducting branch being soldered into the socket end of the connecting piece, and this piece being coated with insulating material, an enclosing socket lined with insulating material is screwed into the hole of the main pipe, and its interior is filled with molten insulating material such as pitch.

When the pipe itself is used as return conductor or middle wire, or when the line is on the two-wire system, one of the bars is dispensed with. When two pairs of conductors are required, a fourth bar can be introduced where the space is shown empty, the four conductors being then arranged symmetrically.

The construction of the cable is seen to be extremely simple, and the materials, apart from the copper, are inexpensive. We are informed, also, that the method of making connections described above is highly appreciated by the outdoor staff at St. Helens on account of its simplicity and economy of time. Of course, like every known system, it has its drawbacks; those which occur to us, on an inspection of the drawings, are the multiplicity of joints in the main, and the somewhat doubtful security of the service



Highfield-Cater Cable.—Longitudinal Section.

Cross-Section at House Connection.

connections. The former, having in view the considerable success of bare copper mains on the Crompton principle, and other many-jointed systems, may, perhaps, be disregarded. As regards the latter, we are told that hot wax is forced into the cables in course of manufacture; it therefore fills the dovetail grooves in the conductors. In making a connection this wax has to be removed, and the metallic surfaces thoroughly cleaned—no easy matter, when the only means of access is through a $\frac{7}{8}$-in. hole. Moreover, there is a considerable likelihood that when the connecting piece is driven home, the split end expanded by the wedge will make but a poor fit with the sides of the groove. Lastly, for every house service, two conductors must be led off in separate pipes, unless a special junction box is provided.

For turning corners doubtless special bends are made; it would be interesting to learn from the inventors whether, and to what extent, the actual built-up cable can be bent without injury. The question of leading away the branch connections is also of interest, as, unless these are flexible, it is difficult to see how a connection is brought round from the left-hand side of the main to a house on the right-hand side, while the top enclosing socket extends a long way upwards towards the surface of the street. The fact that a considerable length of such cable is working satisfactorily at St. Helens, of course proves that the difficulties to which we refer have been overcome.

PROVISIONAL ORDERS, 1901.

The general result of the applications to the Board of Trade for electric lighting orders during the present session is almost identical with that of the previous year.

Ninety-seven provisional orders were granted in 1900 against 98 in 1901, but, in some respects, there is a serious difference—the proportion of orders taken by local authorities and companies respectively shows a marked difference in comparison with previous years, the powers given to the town councils being 67 against 30 to companies.

Of course, it does not follow that the undertakings will be carried out by the municipalities in the proportion indicated by the grant of the powers; on the contrary, the tendency to make arrangements with construction companies to pioneer the business continues to increase—seven deeds of transfer having been approved by the Board of Trade since last year's report, in all cases the local authorities arranging with companies to become the undertakers, and there is no instance of the purchase of a company's undertaking by a municipality.

The seven orders referred to were granted between 1897 and 1900, inclusive, and were probably taken, not so much with a view to municipal trading as with the desire of being able, by possessing the powers, to make the best bargain with competing companies for a transfer.

The falling off in the number of applications for provisional orders by companies is principally due to the development of great power schemes promoted under Acts of Parliament, which embrace the supply of wide areas—the days being numbered for isolated installations in small towns; sooner or later, all such works will be converted into distributing stations, with a serious sacrifice of generating plant, by those local authorities who find themselves within the reach of the mains of a power station supplying electricity upon cheaper terms than can be done locally.

It is practically a necessity for these power schemes to be promoted by private enterprise; no groups of local authorities could undertake such business, any more than they could work sections of the railway system, which must be managed by public companies, unless the whole business is undertaken by the State.

The financial results of the municipal electric undertakings are not sufficiently encouraging to arouse enthusiasm on the part of the ratepayers in speculations of the kind. The accounts are beginning to be understood, and town councillors are now found to be increasingly inquisitive as to the provision for depreciation, antiquation and renewal, without which any statement of successful trading is received with well deserved suspicion.

Investigators may safely apply one or two fairly established calculations in investigating municipal electricity accounts.

Interest and sinking fund require a provision of about $6\frac{1}{2}$ per cent. upon the capital borrowed, and depreciation and renewal (in addition to maintenance out of revenue) a further amount equal to 4 per cent. per annum on the cost of plant.

The above figures are based upon the ordinary period for repayment of the loans—say 25 years; in exceptional cases of a longer term for repayment or low rate of interest, some modification may be made, but not a very important one in the general result.

In the report of the Board of Trade under consideration there are one or two cases of especial interest, for instance, the Urban Council of Alfreton applied for a provisional order, and the result is recorded in the following statement of how it was dealt with:—"Representations were received from ratepayers and others objecting to the application, and

the Board of Trade directed that a local inquiry should be held. After consideration of all the circumstances of the case, the Board of Trade refused to grant the order."

In another case, that of Carnarvon, it was a Mr. E. W. J. Peterson who made the application, and the following are the reasons assigned by the Board of Trade for refusing the grant of the order :—"Representations were received from the Corporation of Carnarvon and others, objecting to the application, and the Board of Trade directed that a local inquiry should be held. After consideration of the report made by the inspector appointed to hold the inquiry, the Board of Trade refused to proceed with the application."

In both these cases, the Board of Trade recognised the wishes of the locality, and if this principle could be generally followed out, applications for provisional orders would frequently be dealt with in like manner, and a substantial grievance on the part of the ratepayers properly dealt with.

We commend this principle to the Local Government Board when asked to sanction loans for speculative undertakings opposed by the ratepayers, although they may be supported by a majority of their representatives on the Council, who were not elected with any such mandate.

The Marylebone applications are also of interest, as in this case, two provisional orders were granted, one to the Corporation and another to a company, notwithstanding the fact that the Metropolitan Electric Supply Company were supplying the district under powers granted to them in 1889.

To those who talk about "monopoly" in electricity supply, this case is an object lesson, and fully carries out Clause 1 of the Electric Lighting Act, 1888, which disposes of all idea of monopoly by the following provision, viz. :—"The grant of authority to any undertakers to supply electricity within any area, whether granted by licence or by means of a provisional order, shall not in any way hinder or restrict the granting of a license or provisional order to the local authority or to any other company or person within the same area."

SOME ALTERNATING AND POLYPHASE CIRCUIT DEVICES.

Alternating and polyphase current circuits are so flexible, that various combinations of arrangements may be readily devised when some development of an existing plant has to be effected to meet the varying demands that are constantly being made upon it, and during the last few years special, yet simple and ingenious devices have been devised, especially by American engineers, which have largely assisted in making transmission schemes so successful. Scott's system of phase-transformation and the Steinmetz monocylic system are well known, but few engineers in this country are acquainted with the devices and arrangements described below.

About two years ago Messrs. C. P. Steinmetz and E. J. Berg patented a method of starting induction motors on single-phase alternating current circuits. Although two and three-phase induction motors start well, and run satisfactorily with short-circuited windings on the rotor and with rotary magnetic fields, they, as is well known, possess no starting torque when supplied with ordinary single-phase currents, unless some phase displacement is produced, when starting, by some auxiliary device which develops a rotary magnetic field. The reason for this is that simple single-phase alternating currents produce purely alternating, and not rotary, magnetic fields. To obtain the phase displacement required to set up a rotary magnetic field, Steinmetz and Berg introduce an auxiliary starting device, which gives to the motor circuit the characteristic property of the monocyclic system. The general arrangement of the motor circuit is shown in fig. 1, in which *a* and *b* represent the single-phase supply mains. The starting device is shown at A, and consists simply of a non-inductive resistance R, connected in series with a coil, L, of large inductance, across the supply mains *a* and *b*, through a double-pole switch S. Both the resistance of the non-inductive coil R, and the inductance of the reactance coil L, may be readily adjusted, and it is obvious that on closing the switch S, a current will traverse R and L, and have a definite phase relationship with the current in the supply mains. The motor M is simply an induction motor with a short-circuited rotor and three field windings F, F_1 and F_2, star-connected as shown, and the windings, F and F_2, are connected in series across the supply mains.

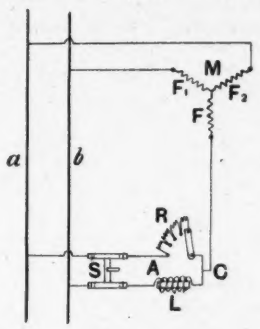


Fig. 1.

From the common junction of the star-connected field windings, the third winding, F, is connected to the common junction, C, of the coils R and L of the starting device, A ; the current which traverses F being decidedly out of phase with that traversing F_1 and F_2, gives rise to a perfect rotary magnetic field, and the motor becomes endowed with the essential property, a good starting torque.

For use with small motors on high frequency circuits, Steinmetz has introduced a modification of the above arrangement, which is shown in fig. 2. In this case a three-phase induction motor, M, has the three field windings, F, F_1 and F_2 mesh connected, the primary terminals, I and II of F being connected directly across the supply mains, *a* and *b*. A condenser, K, is permanently connected across the primary terminals, I and III, whilst a reactance coil, L, is connected across the primary terminals, II and III. The

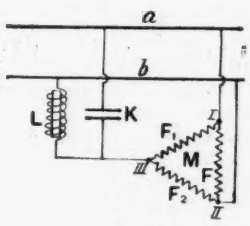


Fig. 2.

function of the reactance, L, is to give that phase displacement at starting which is necessary to increase the starting torque, whilst the action of the condenser, K, is two-fold :—(1) It produces a two-phase relationship between the electromotive forces at starting, and (2) it acts as a compensator for the lagging magnetising current when running, thus improving the power factor of the system by diminishing the input for a given output. Condensers, however, are expensive, and not a commercial commodity at present, and for each horse-power of motor with a full load starting torque for about 125 per cent. full load current, the capacity of the condenser should be 1 kilovolt-ampere. With respect to both these methods, it may be stated that the motors work as satisfactorily as on polyphase systems if the correct combination of resistance and reactance, or of capacity and reactance, for the particular motor employed is realised.

town councils being 67 against 80 to companies.

from ratepayers and others objecting to the application, and

To obtain polyphase currents from single-phase alternating currents Mr. H. Wagner has invented a very interesting arrangement, which will be new to many English engineers. In the vector diagram, fig. 3I, A D represents the E.M.F. of a source of alternating current supply (*i.e.*, alternator or secondary of a transformer) in magnitude and phase, and C D represents the E.M.F. maintained at the terminals of a reactance coil L, connected as shown in figs. 3II and III, so that the angle A D C gives the phase relationship of the two E.M.Fs., A D and D C. A C is consequently the resultant of the two E.M.Fs., A D and D C, and is the pressure utilised in the power circuit. The angle C A D is the phase relationship between A C and A D, and represents the greatest difference of phase which may thus be obtained. If we join C to any point E in A D, we get another E.M.F. C E, and the angle A C E is the phase relationship between the E.M.Fs. A C and C E. By taking other points in A D, as at E_1, for instance, we may obtain other branch circuit pressures, the E.M.Fs. of which make different phase angles with the E.M.Fs. A C and A D. Now, if A C and C E represent the E.M.Fs. maintained at the terminals of inductive branches, as, for instance, the primary windings of induction motors, it is clear that both A C and C E represent the resultant of two E.M.Fs., one neutralising the E.M.F. of self-induction set up in the winding, and the other required to overcome the resistance of the winding, and to do work. These E.M.Fs. are represented by the vectors B C and A B in the case of A C, and by the vectors C F and F E in the case of C E.

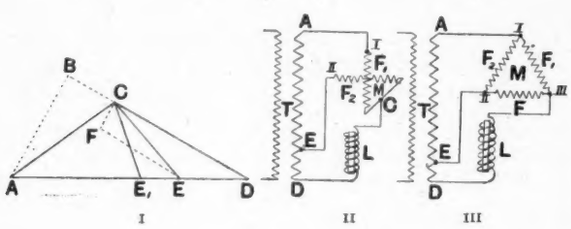


Fig. 3.

In the figs. 3II and III, T represents a transformer, of which A D is the secondary winding. The connections for a two-phase motor are shown in fig. 3II, in which F_1 and F_2 are the two windings, the terminals I and II of which are connected to the two terminals A and E of the secondary of the transformer, whilst the reactance coil L is connected between the terminal D and the common junction C of the two motor windings F_1 and F_2. Fig. 3III shows the connections for a three-phase motor.

TELEPHONIC TRANSMISSION ACROSS THE ATLANTIC.

Dr. Pupin, to whose researches we have frequently called attention, publishes a paper in the June issue of the *Technology Quarterly and Proceedings of the Society of Arts* on "Electrical Wave Transmission."

Electrical wave transmission over a wire conductor, says the author, has a mechanical analogy in wave transmission over flexible cords. The application of a force to one end of a cord develops three reactions—mass, tensional, and frictional reactions.

Similarly, when an alternating electromotive force acts on an electric circuit, the energy imparted to the wire conductor encounters three reactions: *inductance* reaction, which is the same in form as the kinetic reaction of a vibrating cord, and is non-dissipative, its work being stored up in the system as magnetic energy; *capacity* reaction, the law of action of which is identical with the law governing the tensional reaction in strings, likewise non-dissipative; *resistance* reaction, in the overcoming of which heat is generated, therefore it is dissipative. Consequently, in electrical wave transmission, the energy is continually dissipated as heat on account of the resistance reaction, and causes the attenuation which limits telephony over long conductors, particularly over cables.

Evidently, to diminish the attenuation in either of the above cases the non-dissipative factor must be made larger in comparison with the dissipative or frictional reaction, since a relatively smaller dissipation of energy would result.

The following conclusions were drawn from experiments: (1) It is more efficient to transmit energy over a heavy than a light cord. (2) A cord, if periodically loaded, may be made equivalent within any degree of approximation, to a heavier uniform cord. It is to be observed that the distance between consecutive loads must be smaller than the length of the wave which is transmitted.

Similar experiments suggested to the author, in the earlier stages of the research, the manner of attacking the electric problem. In any circuit the magnetic inductance (a source of non-dissipative reaction) is limited. It is well known that coils of wire possess large inductance, consequently such coils should act for an electric circuit in the same way that sinkers do for a cord, and the problem of electrical wave transmission should reduce itself to the placing of inductance coils at proper periodically recurring points on the wire.

In order that such a non-uniform or loaded conductor may act as a uniform conductor of large inductance, it is necessary from mathematical analysis to distribute the loads at periodic distances which are small in comparison with the length of wave which is being propagated.

Since electrical waves in telephony are many miles long, it was impossible to carry out investigations on an actual line. An artificial cable, equivalent to 250 miles of line, was arranged in the laboratory at Columbia University, and inductances were placed at periodically recurring points. The current was measured and the waves plotted for the 250 miles. Using several frequencies, the results of measurements were compared with the mathematical theory, and were in splendid agreement.

The practical value of this discovery is: (1) That wave-energy for telephony and telegraphy may be transferred over much greater distance. (2) If the distance remain constant, it enables wires of smaller size to be used, thus decreasing the cost of installation. (3) With the same weight of wire as in use at present, the distance of transmission may be greatly increased.

In the Atlantic cable, owing to the small magnetic reaction, and also small capacity reaction, the resistance reaction predominates by far, and the dissipation of energy is therefore enormous. By a proper distribution of inductance coils at periodically recurring points, say ¼ of a mile apart, the inductance reaction can be made very much larger than the resistance reaction for all frequencies which are of importance in telephony, and thus the dissipation diminished to any desired limit. The discovery may, says Dr. Pupin, and it is confidently expected that it will, result in telephonic transmission across the Atlantic. It may be worth while stating here that Dr. Pupin's "discovery" reminds us of the scheme proposed by Dr. Silvanus Thompson some years ago, for increasing the speed of telegraphing through long cables.

CORRESPONDENCE.

The Pay and Status of Engineers.

I was much interested in your Leader of 9th inst., and in the main—with the experience of 20 years on many works and several countries behind me—I fully agree with you in your remarks. At the same time, I think that the first half-dozen lines should be modified, or at least qualified.

What is a "proper knowledge of chemistry and physics?" Does not this depend largely on the "line" taken up? For example, if the "line" is electrolytic, *chemistry* is far more important than *mechanical* knowledge.

If, on the other hand, the "line" is steam engine building,

simply of a non-inductive resistance R, connected in series

precise mechanical knowledge is vital, and all the chemical knowledge required can be bought from a specialist as and when required.

Therefore, in the initial stages, a foundation of chemistry —to take that as a *point d'appui*—is all that is necessary or advisable.

For example, a really first-class analytical chemist cannot be made in a technical school alone, and if much time is spent on this line, the time is wasted if the influence at his back, or the tastes of the student direct him into, say, a locomotive works.

Further, I am strongly of opinion, whilst not in any way crying down the value of scientific knowledge, that average every-day engineering does not require more than a modicum of "Professor's science." There is probably no more science required in mechanical or electrical engineering daily practice than in the making of blankets or carpets.

What is of vastly more importance than "high science," which usually becomes rusty by disuse, is (1) a good constitution; (2) sound practical knowledge of men, and materials gained on *works*; (3) "management," which covers a wide range, and of which I propose to treat, briefly, later.

The whole forms a concrete, which, when cemented by a foundational knowledge of "science," and such special scientific knowledge as the engineer has found it desirable to gain in the course of his work, forms a monolith which is worth its cost, since it contains nothing but what is useful and cementitious; anything more may be likened to an excess of free lime or an excessive proportion of magnesia in a sample of Portland cement. An excessive indulgence in "book knowledge" or "drawing office" renders "dirty work" distasteful, and is therefore a direct loss to the individual, though a certain amount, and not necessarily a large one, of scientific knowledge is essential, as a *guide* to practice. An engineer devoid of precise, though elementary, scientific knowledge is not an "engineer" at all, strictly he is only a "mechanic," albeit a useful and valuable man.

On the other hand, a man whose whole time has been spent in the drawing office or technical school is again not an "engineer," unless it be of the "armchair" variety.

For example, you find a "born and bred millwright" putting a jockey pulley on the tight side of a belt. The "armchair engineer" puts his jockey pulley on the proper side, but his belt drive gives trouble notwithstanding, because it has been designed on strictly mathematical lines, and being devoid of practical experience he takes too high a coefficient of friction for his calculations.

The trouble on certain Indian railways some 10 years ago with the breaking of steel axles is a moderate example of "armchair engineering." These axles were of steel and were reduced proportionately in diameter to give equal strength with the old scrap iron axles. But the reduced diameter largely increased their flexibility, and they broke in consequence. Examples might be given to fill a volume, but there is no need.

Next *management*. This term covers such a very wide range that it is impossible to treat it in brief, I propose, therefore, to give my views very briefly as to the relationship between the "engineer" as a scientist and as "manager." As I have before indicated there are two classes of men who may be called "engineers:—"

1. The man whose talents and heart tend to the strictly scientific side of his profession and who has possibly a considerable acquaintance with practice, but his heart being in the laboratory, he is impatient and offhand when called on, say, to settle a dispute with the men in his shops and he cannot be bothered with the commercial department.

2. The practical engineer who has "been through the shops," who knows exactly what each tool is best fitted for, and who is fully able to meet his men on the ground of common knowledge of shop life. He has gained all the scientific knowledge that he needs for his daily work, and to enable him to intelligently direct the labours of others, who as scientists are probably far more knowing than he is. But he has recognised that his business is not to turn out machinery having the highest possible *efficiency*, but machinery which is the best possible *investment*.

For example, it is no use saving 2 or 3 per cent. efficiency in the generators of a lighting station, if to save this you risk disgusting your customers with repeated breakdowns. A reliable service is of vastly more importance than an additional truckload of coal per annum.

This man realises this and acts accordingly. He also fully realises his "wants" in the way of science, and having a full knowledge of his fellow-man and the way to treat him, he is able to surround himself with a staff who are specially picked for their particular jobs, and who, apart from their pay, work their best, feeling that their efforts are appreciated and from a feeling of personal liking for their chief. He, of course, takes the lion's share of the public credit for their work, and quite right too, for it is his practical "business" knowledge which has directed their science into useful, *i.e.*, money-making channels.

I take it that the object of "engineering" is to make money, and that the aim of an engineer is to make a large salary, and he can best do this by paying good dividends. But he is careful not to lose sight of the fact that he cannot possibly personally supervise every small detail of his business, and his credit is, therefore, to a large degree dependant on his staff and the way they perform their work. He is, therefore, specially careful to see that he has a *contented* staff. Such "contentment" is to be obtained in many ways.

A word of praise in proper season will do more with many men than many shillings a week rise of salary.

Another may be encouraged by his chief intelligently discussing his work with him, not as "chief" but as man to man. The "chief" then gets the benefit of his subordinate's ideas, which may or may not be worth money, and the subordinate goes away with the feeling that his chief knows more than *he* does, although not having so much of the X Y business.

On the other hand, fulsome praise given indiscriminately, and often for a very ordinary piece of work, is apt to demoralise a good man, for the subordinate feels satisfied that his chief knows much less than himself, and a really competent man cannot but feel contempt for a chief who knows less than himself, and hasn't even the wit to keep his mouth shut concerning subjects he doesn't understand. Such a man, for instance, who propounds to his staff the conundrum, "How many cubic yards are there in a mile?" and accepts as a perfectly reasonable reply that "I can't tell, because I haven't got a thermometer." This is a *fact*.

To sum up, the most important and most difficult, and, at the same time, most urgently necessary, study for an "engineer" is the different types of "man" and his temperament. No two men are alike, and each requires different handling to get the *best* work out of him. Money *alone* won't do it, and, on the other hand, a competent man won't take fair words in lieu of a proper salary. He looks on that condition of things as he would on a pie without any meat in it.

A speech which would make Englishmen laugh would empty a shop manned by Italians or Spaniards, or any of the "proud" races. Some men can be 'driven," others must be "led," and a good "manager" can do both without lowering the necessary discipline of a large undertaking or raising ill-will.

The greatest army leaders the world has seen have ruled their men with a rod of iron, but combined also with absolute justice and the certainty of reward for meritorious services.

Is it not equally necessary for an industrial army captain to study this art?

A skilled loco. driver studies and humours his machine; is it not still more necessary for the driver of the most complex machine (man) to study *his* machine?

I am afraid that such managers are getting rarer every day.

As to the latter part of your interesting article, is not the want of "grip" on their committee that so many municipal electricians suffer from, largely their own fault, backed by educational cranks?

As far as my experience goes, a really competent engineer can usually get his own way with a committee to a large extent if he—without suffering from "swelled head"—shows that he knows his own value. This value will depend largely on the success of his undertaking. I

am not now writing of the unfortunate who is expected to get high class results from a scrap heap, for I am strongly of opinion that, if the defects are dangerous and he is not allowed to repair them, he should resign. In my own experience he is not likely to lose by such action. Personally —and I have had extensive and peculiar experience—I would much rather work under a man who is absolutely ignorant of engineering than under one who has a smattering of knowledge, which often proves that a little knowledge is dangerous. A great deal of knowledge is not required in an average power house, but it should be "precise," and such as the engineer can rely upon, within the limits of his own capacity, which he should thoroughly know before he is competent to rule others. "Physician, heal thyself."

A competent engineer may often receive valuable hints from suggestions made by a mere business man, who looks at things from the point of view of mere common sense. He may be quite wrong, but, on the other hand, he may be right, for it has been truly said that things just under our noses are lost sight of in looking for distant things, and the more "science" a man possesses the more liable he is to this fault; and, after all, it is scarcely fair to deny the man who pays the piper the right, within reasonable limits, to call the tune. The *limits*, to my mind, are those of safety. It is the engineer's duty to advise his clients how to spend their money to the best advantage; if they don't choose, or are unable to fully adopt his advice, that is their look out. A "strong" man will impress his will on his board. A "weak" one will be a mere plaything. At the same time, you are quite right in saying that there is too great a haggling over capital and expenditure and too little notice taken of the possible results. In short, "capital" is not sufficiently courageous.

I feel this letter has grown to an unconscionable length, but I have felt that I had something to say. I have now said it, and you may print it——if you think it's worth space.

Geo. T. Pardoe.

August 10th, 1901.

The Rights of Consulting Engineers.

A good deal of correspondence has taken place lately in some of the papers respecting consulting engineers and their ways, but nobody seems to have called attention to a course which is being pursued by several public bodies, the object of which seems to be to deprive the consulting engineers of the whole, or at least a greater part, of their fees. The way this is done is simplicity itself. An advertisement is inserted in the papers setting forth that such-and-such a body are prepared to receive estimates from responsible contractors, who will have full liberty to prepare their own schemes. The unwary contractor at once thinks that he has got hold of a soft thing, and goes down to see the work, perhaps some hundreds of miles away, is received with great courtesy, and goes back to his office, gets out a most elaborate estimate and specification, and sends it in. When, however, he comes to think over matters he finds that taking time, &c., into consideration, he has probably spent £20 to £30; still he thinks if he gets the work—which is, say, for £5,000—he will recoup himself. But he is not the only one, and probably 10 to 20 others have done the same and gone to the same expense, so that between them some £250 has been spent. When all the tenders have been sent in, it is found that the prices vary so much and the schemes differ so widely that the people cannot make head or tail of them, so they now decide to call in some engineer and make a bargain with him to compare the tenders and say which is the best and cheapest. They pay him about £10 or £15 and may get the worth of their money, and the job is then carried out somehow. They have attained their object and saved the engineer's fee at the cost of the unfortunate contractor. The resulting economy is a very dubious one, as in all probability they give the contract in the end to the cheapest tenderer, and he probably finds during the progress of the work that he has underestimated the cost, and as he is in business to make money he will to a certainty, not having any check over him, take good care that he does make money somehow. If work is worth doing it is worth doing well, and it is surely the very worst form of economy to have large public works carried out in this hole-and-corner fashion. I do not think that any respectable contractor objects to carrying out work under a consultant who knows his work and does it, but he does object to being made a kind of catspaw to deprive the engineer of his fees and do the work himself for nothing.

Engineer.

Proposed Arbitration Clause.

In most of the specifications issued, the arbitration clauses contained in them make the architect or engineer sole arbitrator in any disputes that may arise. The question of the fairness of this has already, I think, been pretty well thrashed out in your journal. I certainly think that contractors should decline to accept these clauses. I myself substitute the following, which seems to me a fair and reasonable one for both parties.

Disputes.—If any disagreement arise between us in regard to matters contained in or arising out of this contract in the carrying out of the work, the matter shall be referred to the arbitration of some engineer to be named by the President, for the time being, of the Institution of Electrical Engineers, who is to hear the parties or to receive their written statement, but is not to hear or receive written statements through solicitors or counsel, and is to decide the matter as may be just between the parties, his decision being conclusive and binding on both parties.

Engineer.

August 19th, 1901.

Young Engineers' Difficulties.

I should like to draw attention to the great difficulties which beset a young electrical engineer when he has finished his apprenticeship and wishes to get on in his profession. The kind of man I refer to is the one who has had a good education, and has afterwards spent two or three years in a technical college and three or four years in an engine and dynamo works, and who, on finishing his time in the shops, has a tolerably good idea of engineering. Now, on finishing his time, he probably finds his present firm full up, or he may not wish to stay with the same firm, and this is when the trouble begins. He probably writes to, and calls on, another firm, but they politely tell him that they have at present no vacancy; but he, in a few days' time, has the mortification of hearing that such and such a fellow has got a job with the very firm with which he had been in conversation, and in a precisely similar capacity to that in which he had offered his services. Now, he has worked alongside of this fellow in the shops, and also at school, and has himself always been considered a much superior fellow at work, but what does this avail him, for his friend's father has a little more money than his own, and hence a little more influence. I myself am in the above unfortunate position, although I am not out of harness; I am on a job, which I most decidedly should not be had I a chance of a job in my own line. The best way, I think, of preventing the above state of affairs would be to hold examinations in both theory and workshop practice, in which the large manufacturing firms should take an interest, and from the results of which examination they should, as far as practicable, judge of the capabilities of a young fellow and hence draw their supply of young engineers. I trust some other pen than mine will go into this matter.

H. T.

The Purchase of Foreign Machinery.

"British Manufacturer's" letter on this subject certainly treats the matter in a sensible and reasonable temper, admitting, however, the fact that our manufacturers all of them are, for the various reasons given, behind their foreign competitors, and further, that all of them are not first-class.

I may have been unfortunate in dealing with firms in Britain, presumably first-class, but in reality second or third-class. At any rate, "British Manufacturer" need not, like the other correspondents, cast about for other motives for my attitude than those given, namely, that I suffered considerably from the failure of British-made machinery and the intolerable methods of carrying out the work.

Not long ago I had a case wherein a firm confined my

in the generators of a lighting station, if to save this you will depend largely on the success of his undertaking. I

inquiries for machinery for them to Great Britain ; nevertheless, owing to quick delivery from stock, a foreign firm in the end got the order for the dynamo, a British firm supplied the engine, and another British firm a number of motors. The engine broke down twice in the first month, and three motors failed in the same time, and had to be rewound. In the face of such facts, is there any need to impute base motives to the engineer, who, along with his client, necessarily suffers from such unfortunate occurrences ?

I made it a rule years ago to purchase nothing but the standard dynamos, engines, and motors, made by any firm, specifying only what the machinery has to accomplish.

I still think that our manufacturers fail in maintaining a sufficiency of technical skill and ability ; they certainly do not retain the same quantity and quality of scientific experts that the foreign firms of the same pretensions do. It may be true that they have not the money to spend upon new departures designed by experts, even if they had them at their disposal, but that is not argument.

Some British manufacturers have gone to foreign designers for their designs. We all know a good motor made in England by a British firm, a motor of American origin ; we also know the Eickemeyer winding and other details of foreign origin adopted by them. I can well remember the time when the contrary practice prevailed, when all the world followed and copied the British practice, and I cast about for the reason why the position has been reversed.

"British Manufacturer's" reasons may be the true explanation. At any rate, they are weighty and to the point.

A Consulting Engineer.

Central Station Man's Grievance.

Allow me to call attention to "F. W. P's." quotation from my letter in previous issue. If he refers to that issue he'll notice that the terms manipulation, *examination*, and *repair* (partial), suggest the other element or elements he offers as essential. I infer that one who is capable of holding an examination of working parts and suggesting readjustment or repair of same, is a person who has given the theoretical and practical natural laws of engineering his closest attention, and in conjunction with one another.

Also, "F. W. P." urges the necessity of "charge" engineers being capable as resident engineers. I have a good word for all who aspire to higher and more responsible positions when such progress is due to hard application and study, but those (and they are many) who aspire without compunction relative to their worthiness are unworthy of comment.

An electrical student, if he has application, may obtain a very comprehensive knowledge of mechanical engineering ; similarly an "engineer" may obtain a thorough grasp of electrical matters. I can produce evidence of several on either side.

Also, gleaning information on either side is common to both, and *not* peculiar to marine engineers, as one would infer from another writer.

I also see an analogy of "fireworks on switchboards" to broken gauge glasses in boiler rooms ; comment upon this is needless, excepting to students, may be. C. J. Greene, also, is a little hard upon marine engineers ; this is a digression, but I can produce evidence that, in running steam plant of modern battleships, &c., there are several marine engineers (mercantile) second to none, either in the British or any other Navy, relative to capabilities.

San Marino.

One very good reason why marine engineers should not be allowed in the ranks of electrical engineers is that they are so very jealous of an outsider joining their ranks ; everyone must serve an apprenticeship in the shops and go through the usual sea experience before they will allow them to be engineers. If marine engineers wish to become electrical engineers, let them begin at the bottom and serve their apprenticeship in the usual course.

The same remarks apply to engineer officers in the Navy.

I would, however, remark that until I read C. J. Greene's letter in last week's issue, I was not aware that an artificer in the Navy was an engineer officer—or that he was an engineer in any sense of the word. Is it not just a little—a very little—bit of conceit for an artificer to call himself the equal of a marine engineer ?

C. J. Greene makes a startling assertion when he says :—"Now, of course, an engineer officer in the Navy is a far better man than an engineer in the merchant service." Why is he better ? I think C. J. Greene must be very young, or he is suffering from a bad attack of swelled head.

Alec. Gavan Inrig.

"Enlightened Student's" letter has called forth a deal of comment for and against the persons he calls marine fitters.

I am an ex-marine engineer, and have had a fair amount of experience ashore and afloat, but I never before heard the term used. He, therefore, either is ignorant of the status relative to same, or tries to be sarcastic. There are marine engineers and marine engineers, as there are students and students, and I venture to predict that some of the students whom I have had to do with will be like "Enlightened Student," "out of the running," if they do not apply themselves to their studies better, and become students in deed, rather than in name.

All the nonsensical humbug which has afforded others an opportunity to cast slurs on the good names of both parties will not improve matters one whit. The best man wins, be he marine man or otherwise.

The gentleman who, so self-satisfied, speaks of naval engineers, and compares mercantile engineers with naval artificers, forgets the fact that engineers of the mercantile marine, after having served with a second-class B. of T. certificate for 12 months in a position requiring the said qualification, are eligible to become assistant engineers in the R.N.R., and that several hundred men of this class have been drafted into the R.N., *vide* Mr. Goschen, with excellent results. They rank with but after engineers of the R.N. Why so ? I am at a loss to say.

Again, I would like to say that the remarks of another gentleman, *re* the bursting of a gauge glass, would blow some students out of the engine room. He evidently forgets that he was himself a greenhorn once. Such remarks are quite uncalled for. The whole subject may be reduced to two words, "Common Sense," and the more of this asset cultivated by all concerned the better will it be for central stations.

H. T. R.

Leeds, *August 20th*, 1901.

I have read with interest the letter from "An Enlightened Student" (*sic*), and the able replies thereto in your recent issue. I have wondered if the town referred to were Sunderland, and I, the person guilty of this enormity, because it does record my practice most faithfully, except that my charge engineers go up to £2 5s. per week. I welcome the opportunity of raising the question, because it may cause students to think as seriously of the mechanical side of their profession as of the electrical and physical side. It is lamentable to find—and I am heartily sorry for those who have been so trained—able young students handicapped so frequently by their want of workshop training, and to find their theoretical side abnormally developed, and the practical side correspondingly deficient. I am not going to defend the action of a station chief engineer in placing important and expensive steam plant in the charge of ably trained and disciplined men, who know exactly what to do under emergency, are good foremen, and always keen upon the results of their station—I emphatically say young students are not the men to put in such positions—I certainly would not do so, at least. But at the same time, a system I have in vogue here, one due to the suggestion of my station superintendent, himself an old marine engineer, is one which I think will commend itself to you, viz. :—Four youngsters who have served three years at least in the shops, and have regularly attended college, are given a 12 months' finish off here, either on switchboard work, in the mains department, the drawing office, or on the repairing staff. We have our own fitting shops, of course, and they really do get a good 12 months' experience, and several of them have left here to

E

take up good junior assistant's posts. If students ever lament the day they took up electrical engineering, it will be the fault of the individual student, and not that of such a system as is complained of by your correspondent.

I disapprove of premium pupils entirely, but engineering students who have shown their capabilities by their first three years in the shops and at college do become most useful juniors, and ought to be encouraged.

I have suggested a scheme here in connection with the new Borough Technical College about to be opened, viz., that the Corporation should give scholarships annually to students who have served in recognised shops for at least three years, and who have passed out best from the college in applied mechanics, mathematics, steam, and electrical and physical subjects; that is, the mechanical and electrical engineering classes. These scholarships to embrace 18 months in the stations, mains, tramways department, or drawing office, according to my judgment as to their needs, and the vacancies open. I believe such a method will be of great assistance to the youth of the town, and should fittingly complete the first stage of their engineering studies.

John F. C. Snell.

Sunderland, *August 19th*, 1901.

[We are quite "unenlightened" as to the particular station referred to by the original correspondent; but apart from that question, we feel impelled to express our cordial approval of the system advocated—and practised—by Mr. Snell. We trust that other borough electrical engineers will follow his example. There is far too great a tendency—more especially on the part of manufacturers, though there are honourable exceptions—to ignore the urgent necessity of their co-operation with the technical colleges in training young engineers. In this respect the German firms are far ahead of us.—Eds. Elec. Rev.]

I shall be happy to reply to the "marine fitters" that have taken part in this correspondence, when they advance arguments on their behalf, instead of the absurd drivel which they have already written in glorification of themselves at the expense of the electrical students.

An Enlightened Student.

THE INACCURATE PROSPECTUS.

[BY OUR LEGAL CORRESPONDENT.]

The recent case of Glynn *v.* Atherton and Others, which we have reported at some length in these columns, sheds a somewhat lurid light upon the ways and dealings of company promoters.

The numerous cases in which directors are mulcted in damages by reason of the wrongful acts of their colleagues on the board lead one to believe that they sometimes fail to appreciate the full responsibilities of the position which they hold.

The principle that a falsehood is "the intent to deceive" is now shown to apply to erroneous statements in a prospectus. Taking the object of a prospectus into consideration, it is clear that the Court must interpret it in the way it is construed by those into whose hands it comes. The whole object of the Directors' Liability Act of 1899 was to remove a defect in the law brought to light by the decision of the House of Lords in Derry *v.* Peek (14 App. Cas. 337), and to impose upon those who issue prospectuses the duty to take reasonable care not to make untrue statements. The best way of seeing the effects of that Act is to consider its more important provisions side by side with the legal principles which formerly ruled the Courts in these matters.

Prior to the Director's Liability Act, 1890, the law in respect of actions for deceit may be gathered from the following passages in Lord Herschell's judgment in Derry *v.* Peek (14 App. Cas. 337): "First, in order to sustain an action of deceit, there must be proof of fraud, and nothing short of that will suffice. Secondly, fraud is proved when it is shown that a false representation has been made (1) knowingly, or (2) without belief in its truth, or (3) recklessly, careless whether it be true or false. Although I have treated the second and third as distinct cases, I think the third is but an instance of the second, for no one who makes a statement under such circumstances can have a real belief in the truth which he states. To prevent a false statement being fraudulent, there must, I think, always be an honest belief in its truth. And this probably covers the whole ground, for one who knowingly alleges that which is false, has no such honest belief. Thirdly, if fraud be proved, the motive of the person guilty of it is immaterial. It matters not that there was no intention to cheat or injure the person to whom the statement was made. . . . . Making a false statement through want of care falls far short of, and is a very different thing from, fraud, and the same may be said of a false representation honestly believed, though on insufficient grounds. . . . . When a false statement has been made, the question whether there were reasonable grounds for believing it, and what were the means of knowledge in the possession of the person making it, are most weighty matters for consideration. The grounds upon which an alleged belief was founded are the most important test of its reality. . . . . If I thought that a person making a false statement had shut his eyes to the facts, or purposely abstained from inquiring into them, I should think that honest belief was absent, and that he was just as fraudulent as if he had knowingly stated that which was false."

In addition to the liability imposed by Sec. 38 of the Act of 1867, a director should be careful to recollect that other responsibilities are imposed upon him by Sec. 3 of the Companies' Act of 1890, not to mention the Act of 1900, which very materially shows the character of every prospectus. By the Act of 1890, every person who is a director at the date of issue of any prospectus, or notice, and every promoter . . . . shall be liable to pay compensation to all who subscribe for shares, &c, on the faith of such prospectus, for any damage they may have sustained by reason of such untrue statement, unless it be proved (*a*) with respect to every such untrue statement not purporting to be made on the authority of an expert, or of a public official document or statement, that he had reasonable ground to believe, and did up to the time of the allotment of shares, believe that the statement was true; (*b*) with respect to every such untrue statement purporting to be a copy or extract from a report or valuation of an engineer, valuer or other expert, that it fairly represented the statement made by such expert. Provided that the director shall incur liability unless he believed, or had reasonable grounds for believing, that the expert who made the report was competent to do so; (*c*) if the statement made is that of an official person, it is sufficient that it was copied into the prospectus. The director may also escape liability on other grounds, *e.g.*, if he prove that he withdrew his consent to be a director before the issue of that prospectus, and gave public notice of such withdrawal; or that it was issued without his knowledge or consent.

From the above section it will be seen that it is not possible for a director to shelter himself behind the report of an expert unless he is prepared to show that he believed that expert to be competent.

LEGAL.

GLYNN *v.* ATHERTON AND OTHERS.

On Wednesday morning, Mr. Jenkinson, of Hands, Limited, London, was further examined. He stated that he had placed orders with the British Electric Works Company for about £5,000 worth of electrical fittings, after leaving the service of the Free Wiring Company, with which company he had been for a time.

Mr. G. H. Nisbett, engineer and manager of the British Insulated Wire Company, Prescot, said that he went to see the Cheston Road works and considered them to be admirably adapted for making such articles as they were intended for. He considered that it would cost £150,000 to build and equip works like them.

Witness was questioned by Mr. Horridge respecting a report which he had made upon the works, in which he had advised that the company should go on with the work they had been doing until a connection for electrical fittings could be formed. He had also advised that until the Government undertook telephone work, that should be left alone by the company, and also the making of motors, which would have required the engagement of an electrical engineer. He thought it best that the company should build up the business by degrees, and when they had got enough business, employ an electrical engineer.

Mr. J. Banks, electrical engineer and assistant works manager, stated that the machines at the Cheston Road works were capable of turning out electrical fittings similar to those shown in photographs produced.

His Lordship remarked that so far as buildings and machinery were concerned, it had been proved that the works were of the highest order.

In reply to Mr. Horridge, Witness said the company never had plant suitable for making heavy motors, but only for light electrical work.

Mr. J. B. Atherton, recalled by Sir Edward Clarke, was questioned as to certain payments for expenses and in respect of certain shares taken through his own nominees, and with respect to payments for a valuation and report made by Fuller, Horsey and Sons, for use in the prospectus.

His Lordship also questioned Witness respecting alterations made in the report and certificate of valuation in the draft prospectus. Witness explained that the alterations had been made in the draft prospectus owing to certain letters having passed.

Mr. Asquith asked for permission to amend the pleading as regards the terms of the contract with Davidson and Cookson. After an argument, his Lordship allowed amendment as far as J. B. Atherton and Jacob Atherton were concerned, and stated that he should inform the jury that there was no evidence on the point against four of the defendants.

Sir Edward Clarke said he proposed to submit the following questions to the jury:—"(1) Whether any and which of the statements of the prospectus complained of were untrue; and if so, was

the plaintiff induced to apply for such shares by such statements or any of them? (2) Had the defendants, or any, and which of them, reasonable ground to believe that such statements were true? (3) Did the defendants, or any, and which of them, so believe up to the time of allotment? (4) What loss or damage did plaintiff sustain by reason of such untrue statements? (5) Did the defendants, or any, and which of them, make such untrue statement fraudulently and with intent to deceive?"

Mr. Asquith suggested that a further question might be put as to whether the statements were wilfully made.

His Lordship said he would prefer the word "honestly."

Sir Edward Clarke then addressed the jury on behalf of the defendants. He wished the jury to remember that they were dealing not with one person, but with five or six. Each of those persons had a right to ask that his case should be considered as far as was necessary, separately and independently of the others. The serious charge was that the prospectus was issued fraudulently, and the jury were asked to say that there had been conspiracy to defraud. With the exception of J. B. Atherton, the defendants were identifying themselves with an undertaking and risking their own money in the same way as any other member of the public. It was for the jury to look into the prospectus and say whether it contained any misrepresentation. Counsel contended that it did not. Taking the prospectus clause by clause, he affirmed that the truth of the statements had been proved by the evidence given. He argued that, as directors, the defendants were not bound to do exactly the things laid down in the prospectus, and that, as a matter of fact, they had come upon another very important branch of business, the manufacture of shells for Government, and of electric fuses. There had been no misstatement with regard to goodwill, and plaintiff had shown that he had not been influenced by any such statement. Counsel contended that the defendants had succeeded, not only in regard to the evidence as to matters of fact, but also on the ground that the plaintiff himself was not deceived by the prospectus. He urged upon the jury, on behalf of all of the defendants, that there was no pretence for suggesting that there was fraud of any kind in the issue of the prospectus.

Mr. Pickford addressed the jury on behalf of Mr. Goffey, urging that he knew nothing of the earlier prospectuses, and only came on the scene when the company was floated. Whatever the fact might be with regard to the other defendants, Mr. Goffey came into the matter without any previous knowledge of R. F. Hall & Co., Limited.

Mr. Asquith, in replying, said that as one result of the prolonged investigation, the jury would be able to discard a great quantity of matter which had been placed before them, and to concentrate their attention on what was the gist and substance of the whole matter, namely, whether the prospectus issued in the month of April, 1899, was a fair and honest prospectus. He submitted that the prospectus was misleading, and that it contained untrue statements, and that there were omissions from it of matters which were material, and which ought to have been known. He would submit, whether the prospectus as a whole, was an untrue statement of facts which were material to be known by the persons to whom it was addressed. Counsel proceeded to review the defence and the history of the company. Speaking of the works, he said it was untrue that they were specially designed for the manufacture of electrical fittings, and the patents, of which much had been made, were not valuable. The company had never supplied a single telephone to anyone, and were never, in the whole of their history, capable of producing a single telephone, and the same was the case with respect to motors. There never was a day from the formation of the company to the date of its winding up, when it was a profitable going concern. Respecting the evidence of Mr. J. B. Atherton, counsel said that the failure of Mr. Atherton to disclose the fact that he had been negotiating privately with Davidson and Cookson to float the company, was in itself fraudulent.

At a late hour his Lordship addressed the jury. Explaining the law bearing on the case, he proceeded to deal with the history of the case as set forth by the evidence. His Lordship had not concluded his address when the Court adjourned until Thursday morning.

The hearing was resumed on Thursday morning.

Mr. Justice Bucknill, in summing up, asked the jury to put out of their minds the non-success of the British Electric Works Company, because the success or non-success of a company had nothing to do with fraud at its inception, and fraud was the first of the three charges brought against the defendants. To establish that charge it was necessary to prove that they had made statements which they knew to be untrue, or that they had made statements without belief in their truth, or recklessly, careless whether they were true or false. In this and in every other instance the case of each director must be considered separately. The second charge was under the Directors' Liability Act, 1890, and under that Act it was enough to show that the defendants had made untrue statements without reasonable belief in their truth. But it must be understood that untrue statements in a prospectus were not to be confined to active misrepresentations of the truth. If there were material omissions of such a character as to alter its nature and purport, and to give it a different complexion from what it otherwise would have had, then those omissions made such a prospectus untrue, and the persons who put their names to it were liable. A prospectus must not be cunningly and cleverly contrived to convey a different meaning from its obvious meaning. On the contrary, its issuers must take care that it should be so worded as to be unambiguous and clearly understood by ordinary men. The public had, as Lord Bramwell said, a right to be protected from company promoters. The third question that the jury would have to decide, was whether the contract between Mr. J. B. Atherton and Messrs. Davidson and Cookson concerning the placing of the debentures, by which that firm was paid 10 per cent. commission, was a contract material to be known to intending investors. If it was, it would make the prospectus fraudulent as against any director knowingly issuing the same. He need not remind the jury that the Athertons were the only directors who knew of the existence of this contract. His Lordship then reviewed the history of the company at considerable length and went minutely into all the evidence.

A number of questions were left to the jury, who returned the answers detailed in our last issue.

Judgment was accordingly entered for the plaintiff for £950.

BUSINESS NOTES.

Electrical Wares Exported.

Week Ending Aug. 21st, 1900.		Week ending Aug. 20th, 1901.	
Amsterdam	Value £115	Adelaide	Value £38
Beira. Teleg. mat.	4,510	„ Teleg. cable	456
Bombay	586	Alexandria	86
Brisbane	125	Bergen. Submarine cable	3,060
Calcutta	600	Bombay	10
Cape Town	507	Brisbane	46
„ Teleg. apparatus	150	Buenos Ayres. Teleg. wire	375
Christiania. Teleg. wire	50	Calcutta	292
Durban	642	Cape Town	438
East London	£95	„ Elec. tramcars	2,200
Foochow	18	Christiania. Teleg. wire	81
Fremantle	163	Colombo	67
Gibraltar. Teleg. mat.	400	Copenhagen. Teleg. wire	25
Hamburg	200	Demerara	110
„ Teleg. mat.	250	Durban	226
Melbourne. Teleg. cable	1,204	East London	49
„ Tramway cable	640	Flushing	30
Port Elizabeth	160	Fremantle	235
Rio Janeiro. Teleg. mat.	242	Guayaquil	35
Rotterdam. Teleg. mat.	250	Hong Kong	25
Singapore	61	Lytt eton	75
Stockholm. Teleg. mat.	477	Madras	64
Sydney	931	Manila	10
„ Teleg. mat.	210	Melbourne	518
„ Tramway cable	627	Ostend	50
Trinidad	45	Perth	150
Wellington	283	Port Elizabeth	56
		Rotterdam. Teleg. mat.	20
		Rouen	198
		St. Petersburg. Teleg. mat.	200
		„ Teleph. appar.	315
		Shanghai	400
		Stockholm. Teleg. wire	97
		Sydney	543
		Wellington	89
Total	£14,343	Total	£10,569

Foreign Goods Transhipped.

Adelaide. Teleg. apparatus Value £70

Bankruptcy Proceedings.—Under the failure of W. Rushworth Beckton, electrical and general engineer, 13, Brownlow Street, Holborn, the first meeting of creditors was held on Tuesday, at the London Bankruptcy Court, before Mr. E. L. Hough, senior official receiver. The debtor states that in December, 1898, having previously been employed as chief engineer at the Hotel Cecil, he started business on his own account at the above address. At the outset he had a capital of £1,000, but laid out £600 on dilapidations and fitting out the workshop. The remaining £400 was absorbed during the first year of the trading, and he has since had to borrow £750 from various persons. Until a month ago he considered that he had a really sound business, and that his embarrassments were merely due to want of capital, which he endeavoured to remedy by borrowing. The failure is ascribed to bad debts and want of capital. Having called over the proofs lodged by creditors, the Chairman stated that the debtor had just handed in a statement of affairs which showed ranking liabilities £997, against assets valued at £375, after deducting £62 for the preferential claims. On behalf of the debtor it was stated that a brother would probably come to the rescue, and a scheme of composition would be submitted to the creditors. After some discussion it was decided to adjourn the meeting for a fortnight to enable the offer to be formulated and lodged with the official receiver.

Catalogues and Lists.—Messrs. Graham, Morton and Company, Limited, send us a circular in which they illustrate some of the coal elevating and conveying machinery which has been furnished by them for various works.

The Holtzer-Cabot Electric Company, of Brookline, Mass., has sent us a small pamphlet showing the H.C. magneto igniter for gas engines.

A pamphlet is being issued by the Synchronome Syndicate Limited, of Clerkenwell Road, E.C., which is a reprint of an article contributed by Mr. F. Hope-Jones to a contemporary on "Electric Time Service."

The Johnson-Lundell Electric Traction Company, Limited, have published a number of lists describing their system of traction, power and lighting generators. The lists are well illustrated with diagrammatic and pictorial reproductions, and are arranged conveniently in a file which allows additional lists to be interleaved or added without much trouble.

The Cassel Self-regulating Water Wheels, Limited, send us a copy of the preliminary issue of their catalogue of constant speed water wheels, of which we gave a description in our issue of July

12th last. The special feature of these wheels is that they automatically maintain constant speed under all conditions of load. Details of the various sizes and types of wheels manufactured are given, with prices and excellent illustrations, and extracts from magazine articles, &c., bearing upon the subject. From a test made by Mr. E. C. de Segundo, consulting engineer to the company, it appears that throwing the whole load on or off a 4·6 H.P. wheel caused a momentary variation from normal speed of 1·8 per cent., while in a few seconds the speed became normal again; for all practical purposes this amount of variation is quite negligible.

Messrs. W. H. Bailey & Co., Limited, Salford, send us their catalogue of improved steam stop valves, automatic exhaust relief and back pressure valves, parallel slide gate valves for high or low pressures, reducing valves and regulators, &c, with excellent illustrations.

We have received samples of "Okonite" and "Manson" tapes for insulating joints in conductors, with suggestions for tests to be made with them. Some of these we have roughly carried out, and they certainly bear out the claims of the agents (Messrs. Geipel & Lange) as to the waterproof and adhesive qualities of these tapes, which appear to be very suitable for their purpose.

Messrs. R. W. Blackwell & Co., Limited, have issued an illustrated catalogue and price list of their well-known I.T.E. automatic circuit breakers, of the laminated edgewise type. These are made to suit all possible conditions of over or under load, single or double pole, for direct or alternating current.

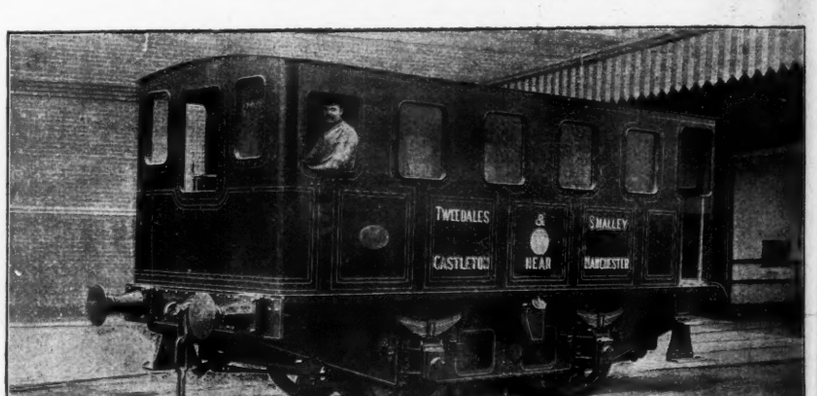
The British Thomson-Houston Company, Limited, send us pamphlet No. 106, illustrating and describing their three-phase rotary converters up to 900 KW. Twenty-one of these machines are in operation in this country in connection with electric railways and tramways.

Books Received.—"A Handbook for the Electrical Laboratory and Testing Room," by J. A. Fleming, F.R.S. Vol. I. London: The *Electrician* Printing and Publishing Company, Limited. 12s. 6d.

"Directory for Use in Schools and Classes in Connection with the Board of Education." Part II. London: Eyre & Spottiswoode. 1901. 3d.

Dinner.—Messrs. Buchanan & Curwen, electrical engineers, of Westminster, who have recently carried out some important works in connection with the electric light installation at Beckenham, gave a dinner to their employés at Beckenham on Saturday night. About 60 were present, and a very enjoyable evening was spent.

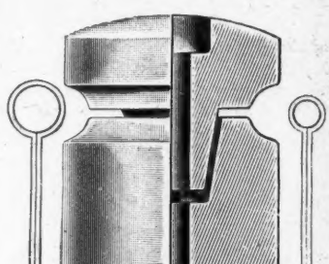
Electric Shunting Locomotive.—An electric locomotive capable of drawing 120 tons has recently been completed at Messrs. Tweedales & Smalley's works, Castleton, near Manchester, for use on their siding connected with the Lancashire & Yorkshire Railway. The current is obtained from a Monobloc accumulator capable of discharging up to 390 amperes, which furnishes the current to two Electric Construction Company's motors. The locomotive is mounted on two axles, with four wheels, 43 in. diameter on the tread. Each axle is geared to an E.C.C. enclosed traction motor by double reduction machine-cut spur gear, having a total ratio of 20 to 1. Each motor gives a horizontal effort at the tread of the wheels of 2,500 lbs. The motors also give 1,000 lbs. horizontal effort at from 3 to 4 miles per hour with 68 amperes and 120 volts. They are specially designed to operate in conjunction with storage batteries. The controller is of the series parallel type, effecting these combinations on the motors, and not by manipulation of the battery. The locomotive is complete with instruments for registering charge and discharge of the battery and controlling the locomotive from either end for shunting operations. The total weight in running order is 22 tons. At the trials which were recently conducted the result was in every respect satisfactory, the locomotive starting with ease under the maximum load required, and being under perfect control. In shunting operations in connection with goods yards there is doubtless a considerable field for the electric locomotive, for not only is the risk of fire amongst timber and other inflammable goods avoided, but actual economy should result from the fact that the ordinary locomotive has to be kept under steam for many hours in order to be available for comparatively short periods of use. Apart from this, the labour required for the manipulation of an electric locomotive is considerably less than that which has to be provided for its rival the steam locomotive.



Electric Shunting Locomotive.

Forthcoming Book.—Part II. of "The Indicator Handbook," by C. N. Pickworth, Wh.Sc., dealing with the analysis and calculation of indicator diagrams, will be published by Messrs. Emmott & Co., Limited, shortly.

New Insulator.—From Messrs. Atkinson, Schmahl & Co., Newcastle-on-Tyne, we have received samples of the "Asco" two-part insulator. The insulator consists of two pieces of hard fired porcelain with galvanised metal clip or clips to take insulated cable of various sizes. The upper part of the porcelain holds the clip in position, and an ordinary wood screw fastens the three parts firmly together, at the same time fixing the insulator in position. The advantage of this form of insulator lies in the fact that the insulation is not so liable to be cut or damaged, and that no binding wire



is necessary. It seems to us that the insulator is easily and quickly fixed; it should answer well, for insulated telegraph or telephone cables, or for indoor work. The insulator is made in three sizes, which, with corresponding clips, will carry cable up to ⅝-in. diameter. Our illustration shows the smallest size with the two clips taken out; the upper portion of the insulator passes through the extended portion of the clip, and, when screwed down, holds it firmly in position.

Gas Engines.—According to a leaflet which has reached our hands, recent orders for "Stockport" gas engines comprising a total of over 3,700 B.H.P. have been placed with Messrs. J. E. H. Andrew & Co., Limited, Reddish.

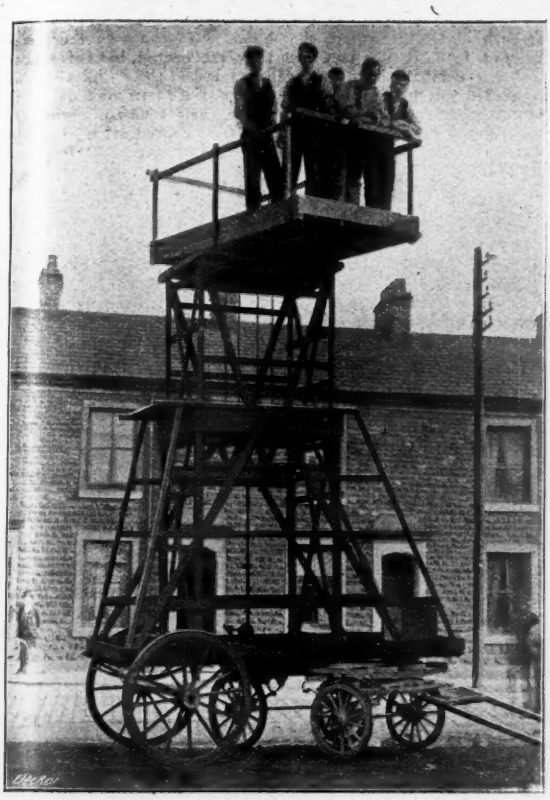
Imports of Foreign Electrical Plant.—July proved to be a quiet month as regards the importation of foreign electrical goods and apparatus into this country, the value amounting to only £42,107, as compared with £54,367 in the previous month and £129,022 in July, 1900. For the seven months ending with July last, however, the value of such imports has reached a total of £595,073, as contrasted with £549,275 in the corresponding seven months of 1900.

Ironmongery Exhibition.—At the trade exhibition held in the Agricultural Hall during the current week were two or three very creditable stalls, more particularly of the class of goods suitable for the ironmonger's stock. Principal among these was the interesting exhibit of the Berliner Telephone Company, comprising the several types of their domestic and other telephones. Messrs. Gent & Co. displayed a great variety of electrical appliances, and the Stewart Electrical Syndicate also had a good show. The Meyra Electrical Company had a large exhibit showing the useful applications of the Meyra dry battery. Messrs. Falk, Stadelmann & Co. had one of the most attractive stalls in the building, and although not in any marked degree electrical, it included good examples of such everyday requirements as lamps, bells, telephones, &c. The Renewable Electric Lamp Company had an interesting stall showing the processes of manufacture of an incandescent lamp. The following firms were also exhibitors:—Messrs. W. F. Dennis & Co., Messrs. Fuller, Macleod & Co., Messrs. Frankenburg, Harris's Patent Feed Water Filter Company, Messrs. Chas. Joyner & Co., and

Messrs. C. J. Thursfield & Co., the last-named having a very artistic show of electric light fittings of early English designs in antique finishes.

Pumping Plant.—Messrs. Easton & Co., Limited, have just received information from Egypt that they have secured the order for the pumping plant for the Etsa drainage station. The plant in question consists of six Lancashire boilers, two economisers, four vertical compound condensing engines direct coupled to four large centrifugal pumps, with all necessary steam and exhaust pipes, feed pump and feed pipes, &c., and is designed to raise 6½ million gallons of water per hour against a head of about 15 ft. Messrs. Yarrow, of Poplar, have also placed an order with the firm for one of the Schmidt patent superheaters for use in their works.

Tower Wagons.—Messrs. S. Rawlinson & Son, wagon builders, of Blackburn, have sent us a photograph, which we reproduce below, of one of their safety tower wagons, shown under a severe test, bearing the weight of five persons on the extreme end of a 9 ft. × 4 ft. 9 in. platform which is slightly turned towards the front. The carriage is mounted on six wheels and has two separate locks. The fore carriage is turned almost at right angles as in taking



Tower Wagon.

a sharp curve. The platform revolves completely round on roller bearings, and is worked by a hand wheel from the top whilst the men are at work. The guard rails are made to lie almost flat on the platform, so as to pass under archways. One man can lower the tower at one operation, and it is quite safe when in position. There is a good lever brake on the hind wheels, and a screw for lifting the tower; also a ladder, which is not shown on the photograph, is fitted. If required the platform can be extended to 12 ft. length.

Trade Announcements.—We are informed that Mr. H. C. Weekes, late of Messrs. Veritys, Limited, will in future represent the Sun Electrical Company, Limited.

Trinidad Bitumen.—Messrs. Rowland Carr & Co., of Lime Street Square, E.C., are the sole agents for the United Kingdom for the Asphaltic Company, of Birmingham. Their electric bitumen for filling in troughs on the solid system contains (as shown by analysis) at least 75 per cent. of pure bituminous matter, and only 25 per cent. of mineral earths, which is claimed to be a better proportion than any other Trinidad bitumen refined in this country. This is stated to result in a greater gain in the insulating power, and in the water-proofing capacity, whilst the cost of using it is reduced, as owing to the increased richness in bituminous matter, and the low specific gravity, it covers a greater area, and there is practically no refuse earthy matter left in the boilers. Messrs. Carr state that they are now supplying this bitumen very largely for electric cables in various cities and towns in the United Kingdom. They also supply a high-class clarified bitumen for use in joint boxes.

ELECTRIC LIGHT AND POWER NOTES.

Aberdeen.—A short circuit occurred on the lighting mains on Friday last, causing a cessation of supply for a short time.

Barnes.—The L.G.B. has given its sanction to the Council borrowing the sum of £3,000 for electric lighting purposes.

At a meeting of the U.D.C. the Electric Lighting Committee reported that the County of London & Brush Provincial Electric Supply Co. was supplying current to the Ranelagh Club and to the Manor House, both within the Council's district. It was stated that the company's action in the matter was illegal, and it was decided to apply for an injunction. It will be remembered that we drew attention to this curious position in our description of the Barnes electricity works. The company has power to supply within the grounds of the Ranelagh Club, but the club house itself is within the Council's area; provided that the company's *mains terminate within its own area*, the company apparently is not exceeding its powers. The point is of great interest, and of some importance.

Barnstaple.—The T.C. has declined the proposals of Messrs. J. F. Carrington and R. H. Scotter to build and equip an electricity works at Barnstaple.

Boston.—Mr. A. Collins has submitted a report to the T.C. upon the lighting of the borough by electricity, and advises the Council to commence operations with works which will not be outgrown in a year or so. He recommends that a scheme for a supply to 10,000 8-c.p. lamps be provided on the direct-current three-wire system at 220 volts.

Bradford.—The Corporation has just given a large order for electric motors because of the great increase in the demand for these machines recently.

Bredbury and Romily.—Mr. C. L. Turner, consulting electrical engineer, Manchester, has been appointed by the U.D.Cs. to prepare a scheme for the supply of energy for electric lighting, power and traction in their districts.

Bromborough.—The proposal of the Lower Bebington U.D.C. to take over the electric lighting of the Bromborough district, was agreed to at the monthly meeting of the Bromborough U.D.C. last week.

Farnworth.—The D.C. is supplying energy for lighting free, and will continue to do so until the formal opening of the new generating station, which takes place on the 28th inst. Several cotton mills in the district are being fitted for electric lighting.

Hebburn.—The Electricity Committee last week reported that an agreement had been come to with the Northern Counties' Electricity Supply Company for supplying and lighting the public lamps in the compulsory area, and the Council's prov. order will be transferred to the company.

Hoylake and West Kirby.—The L.G.B. has sanctioned the borrowing of £13,500 by the D.C. for electric lighting purposes.

Loftus.—The Cleveland and South Durham Electric Power Company is going to apply for a prov. order to supply electricity in the Loftus district.

Mansfield.—The T.C. is about to raise £50,000 for electricity works and a refuse destructor, and has fixed the scale of charges for energy at 6d. and 2d. per unit for lighting, 4d. and 1d. for power, on the maximum demand system.

Ryde.—The E.L. Committee has drawn up a draft agreement with Edmundson's Electricity Company, Limited (for the Isle of Wight Electric Light and Power Company, Limited), for the construction and maintenance of electricity works under the Council's prov. order, and the B. of T. has deferred the question of revoking the order for 12 months. The Committee recommended that Messrs. Kincaid, Waller & Manville be paid £500 in full discharge of their claim against the Council for preparing a scheme.

South Bank.—The U.D.C. intends to apply for a prov. order for electric lighting.

Stockton.—The R.D.C. has decided to apply for a prov. order to supply electricity. It is not proposed to erect an electric power plant, but to purchase in bulk from the Cleveland and South Durham Electric Power Company or the Stockton Corporation, and retail it in the principal villages of the district—namely, Eaglescliffe, Norton, Preston-on-Tees, Billingham, Carlton, Hartburn, and other places which come under the control of the Rural Council.

Stretford.—The report of Mr. C. H. Wordingham on the proposal of the D.C. for supplying electricity in the area of the Council has been adopted. Mr. Wordingham estimates that the lighting of the streets in the compulsory schedule would cost approximately £12,000, and there would be £2,400 in addition for fuses, meters, and service lines. The probable cost of establishing the electric supply would be £36,800, apart from the cost of reconstructing the tramway track and erecting overhead equipment.

Swadlincote.—The Provincial Electric Supply and Traction Company has given notice to the D.C. of its intention to apply for a prov. order to supply electricity in the district.

Emmott & Co., Limited, shortly.

Tynemouth.—The T.C. is going to borrow £23,000 for extensions of the electricity works.

Whitehaven.—The T.C. has decided to raise the charges for electrical energy. It has had to raise additional capital for the purpose of relaying practically the whole of the electric lighting cables in the town. The charges from October 1st will be £12 per annum and 2d. per unit by meter, or 6d. per unit by meter. It has also been resolved that Mr. T. Bell be appointed assistant electrician at a salary of £150 per annum. The B. of T. has sanctioned the Council doubling the pressure on the mains, from 210 to 420 volts.

Widnes.—A report to the T.C. from the Gas, Water and Electricity Committee, states that the confirming Bill of the electrical prov. order having received Royal assent, it has been resolved to appoint a sub-committee to consider the steps to be taken to provide for the supply of electricity within the borough, and as to the desirability of making provision for the establishment of a system of electrical tramways.

Woking.—The difficulty between the U.D.C. and the Woking Electrical Supply Company has been settled on the payment by the Council of £63 as final damages. The Council admitted that they had committed a technical breach of their contract with the company. The latter will now disconnect their cables from the street standards at the Council's expense, and the gas company will proceed to carry out their new contract without delay.

Worksop.—The D.C. has appointed Mr. J. P. Crowther resident electrical engineer, at £125 per annum.

ELECTRIC TRACTION NOTES.

Belfast.—The Belfast Street Tramway Company holds a lease from the Corporation, some six years of which have to expire. Twelve months ago negotiations were entered on by the Corporation with the view of acquiring the interest of the company for the unexpired years, but the price asked was too high. Lately the company—after declaring a dividend of 7½ per cent.—has reduced the service on some of the extensions on the ground that the existing service does not pay. It is now expected that the Corporation will make another offer to take over the tramway system and substitute electric traction for horse haulage.

Berlin.—The completion of the Berlin Electric Underground Railway has been very much delayed of late, owing to the immense quantities of underground water which have to be pumped out. It is believed that the line cannot be opened at the time fixed, because one of the large pipes near the Emperor William's Memorial Church suddenly burst, inundating a rather large portion of the tunnel. Large suction pumps were set to work at once, day and night, but it seems probable that the completion of the railway will be retarded for some time.

Birkenhead.—The three new electric car routes in Birkenhead, which were ready for opening, were inspected last week by Lieut.-Colonel von Donop, R.E., B. of T. inspector, and were formally opened with a public ceremony and luncheon.

When responding to the toast, "Prosperity to the Municipal Tramways," which was submitted after the luncheon by Alderman E. G. Mason, Dr. Pearson said that the most remarkable thing in tramway traction was, that it created quite a new traffic. It was startling to think that in one week they had carried on the New Ferry line more than half the population of Birkenhead, and that without affecting the ferries, the Mersey Railway and the joint railways to any great degree. He anticipated that it would be the same on the routes they had opened that day. There was no doubt the undertaking would have a satisfactory financial result if the public did not ask them to carry them for nothing, or next to nothing. When the New Ferry route was first opened they took £180 in a week; he was pleased to say that sum had increased to £300 a week.

The whole of the routes passed by the Board of Trade inspector up to last week comprise 7 miles 2 furlongs 6 chains of route, representing 11½ miles of single track. Section boxes are placed at a distance of half a mile from each other, and each box is provided with a telephone connected with the generating station. To complete the system of electric tramways in Birkenhead, a little over four miles have yet to be finished and opened.

The overhead electrical work of the new routes opened last week has been carried out by Messrs. R. W. Blackwell & Co., London. The cables were supplied by Callender's Cable Company and the British Insulated Wire Company. The trucks were manufactured by the Peckham Truck Company, of U.S.A., and the motors by the British Thomson-Houston Company. The cars have been made by Messrs. G. F. Milnes & Co., Birkenhead. The work of construction has been carried out by Mr. Chas. Brownridge, borough engineer, Mr. W. Bates, electrical engineer, and Mr. R. H. Rinder, superintendent of works. The general management of the Birkenhead tramways will be exercised by Mr. A. R. Fearnley. A return of the traffic up to and inclusive of Sunday shows that on the three new routes the receipts per car mile averaged 1s. 3d.

Bradford.—The Corporation has just fixed a fare of 3d. for the journey of 4½ miles by the new electric tramway to Queensbury, a rise of 800 ft. At Queensbury the terminus is immediately adjacent to that of the Halifax lines, and the total fare from Bradford to Halifax is 6d., as against a railway fare of 8d. The railway fare from Bradford to Queensbury, where the station is a mile distant from the town, is 4½d. Passenger traffic on the Great Northern Railway branch between Bradford and Halifax may be regarded as almost wiped out.

Bristol.—The Bristol Electric Tramway Company last Saturday paid off 300 employés who had handed in notices at the beginning of the week. They wore union badges, which the directors considered an act of insubordination.

The tramway service is now normal, and hostile demonstrations by sympathisers with the trades unionists who have left the service are practically at an end. There has, however, been a development of a very serious kind in the direction of placing obstructions on the tramways. Allusion to this having occurred was first made in one of the speeches during proceedings in a tramway prosecution for another kind of offence at the Bristol Police Court, and the intimation thus given was followed by the issue by the company of large posters, offering £100 reward for information which would lead to the conviction of the offenders. These posters gave details of half a dozen instances in which bolts, pieces of iron rod, and stones had been placed in the grooves of the metals, and, although no disaster has been reported, the running off the line of one car is attributed to such obstructions. At the meetings of the men there is no attempt to deny the fact that they are beaten, but it is said the tramway company have not seen the last of their difficulties, and continued efforts will be made to get their new men out of the service, not by threats of violence, but by persuasive means. The trades unionists are arranging "a monster demonstration" for Saturday, the 24th inst., and they express confidence that 30,000 persons will take part in it.

An accident, which was alarming rather than really serious, occurred to two electric cars on Tuesday night. They were approaching each other on double lines, but happened to reach a narrow piece of road where the lines interlaced, at the same moment. A corner-to-corner collision occurred, in which the cars were much damaged, and passengers shaken and greatly alarmed. A driver and two passengers received bruises, and one of the female passengers was for a time unconscious.

Cheltenham.—Colonel von Donop, R.E., on behalf of the B. of T. last week made an official inspection of the newly-constructed electric tramway from Cheltenham to Cleeve Hill.

Derbyshire.—A scheme is in progress for the construction of an electric railway from the Midland line at Hope Station to Bradwell and Castleton, traversing a beautiful district, and giving ready access to these two popular holiday resorts.

Dundee.—The Tramways Committee has decided to recommend the T.C. to adopt a parcel delivery system in connection with the electric cars.

Failsworth.—The arbitration between the D.C. and the Manchester Carriage and Tramway Company for the value of the tramways in the district was to take place in London yesterday and to-day. An amended agreement with the Manchester Corporation as to the cost of the purchase, reconstruction and maintenance of the tramways in Failsworth has been received by the Council. The Manchester Corporation will pay such sum per annum as will cover the cost of the outlay, also interest on borrowed money for a period of 21 years.

Glasgow.—A number of electric car accidents occurred in the burghs of Govan and Partick on Saturday, but fortunately none was of a serious nature. An electric car collided with a bread van; the van horse was overturned, and the driver badly injured. A workmen's car collided with a Partick street sweeping machine, with the result that the driver was thrown to the street, sustaining a large wound on the side of his head, and an injury to his shoulder. A man who was in the act of running across Dumbarton Road was knocked down by a car and seriously injured internally.

Two other accidents occurred in Glasgow, a boy and a man being knocked down and more or less seriously injured.

A trolley on Monday last slipped off the wire, and the pole broke the guard wire, which fell across the trolley wire and knocked down a horse which stepped on the live end.

Hampton.—Mr. George White and Mr. Clifton Robinson, of the London United Tramways, as a result of an interview with the U.D.C., have agreed to widen Thames Street to the Council's requirements, and to construct the line within a period of three years.

Leeds.—Rounding the curve from Leeds City Square into Park Row last week, an electric car met with an accident which delayed traffic for about 20 minutes. The trolley wheel accidentally ran on to the wrong wire, with the result that the trolley rebounded and got entangled with the other wire, which was thereby stretched and loosened, while most of the wooden guard strip at this point became detached and fell to the ground. Fortunately no one was injured.

Leicester.—The Highways Committee has presented a report recommending that the County Council should at once take into consideration the policy of itself constructing light railways in the county, and leasing the same. Greater facilities of communication were needed in some of the populous districts in the county, more particularly Oadby, Wigston, Enderby, Anstey, Thurmaston and Syston, in the vicinity of Leicester. To enable railways to be constructed and provide for the road traffic, it would be necessary

to widen the macadam part of the roads, and in one or two instances to acquire additional land. In the first instance, therefore, it was proposed to submit a scheme dealing with this area. The committee had approached the Corporation of Leicester, who were about to construct electric tramways to the boundary of the borough upon roads leading in the direction of these places, with a view of ascertaining whether it was the desire of the Corporation to come to an arrangement for working the railways to be constructed by the County Council immediately adjacent to the borough boundary. The lengths of the railways from the borough boundary to the places above indicated would vary from one mile in the case of Oadby to three miles in the case of Enderby. The scheme of railways to be recommended by the committee must depend upon the result of the negotiations with the Corporation, for if the electric power for the working of such railways was provided in the county, it would be necessary to construct certain connecting railways, which otherwise it would probably not be expedient to make at the present time if such railways were worked by motive power provided from Leicester. The report was approved.

Liverpool.—The new regulation made with a view to the prevention of undue crowding on the electric cars of the Liverpool Corporation came into force on Monday. Each car is now "licensed" to carry 31 passengers inside and 43 outside. Inside there is seating accommodation for 24 persons and outside for 34, so that the new regulation permits seven persons to stand inside a car when all seats are occupied, and nine to stand on the top of the car when the seats are taken. This gives a total per car of 58 persons sitting and 16 standing, or 74 in all.

Mr. T. Utley, a member of the City Council, has subjected the management of the Liverpool electric car service by the Tramways Committee to a long and searching criticism. He shows that extensive alterations in the overhead equipment have been made at the expense of the Corporation, and contends that the Tramways Committee ought to have seen to it that these alterations were covered by the contracts for construction. The maintenance and renewal of cars last year, he says, cost £23,300, in addition to the repairs the contractors had to do during their guarantee. In no other city on the Continent or in the United Kingdom, he states, has such extensive reconstruction taken place as is now taking place in Liverpool. Speaking of the German motor and trailer cars, he declares that these, which cost £900 each about three years ago, are not worth £5 to-day. Mr. Utley further criticises the business policy of the Tramways Committee, and avers that by charging the tramways undertaking less than the cost of production of the energy required for the service, the price of electric energy to private consumers has to be kept so high that it is impossible for the Committee to develop this branch of their business.

Owing to the fall of an overhead guard wire on the James Street approach to the pierhead terminus on Sunday evening last, the electric car traffic was stopped for nearly an hour.

Manchester.—There is no immediate hope, it is stated, of the deadlock between the Manchester and Salford authorities in connection with tramways being removed, and the probability of a working arrangement between the two Corporations is gradually growing smaller.

Oswestry.—The Light Railway Commission has authorised the Tanat Valley Light Railway Amendment Order.

Radcliffe.—The B. of T. has sanctioned the borrowing of £60,000 for electrical tramways. Of this £41,845 is for permanent way and car sheds, £11,602 for electrical equipment, £6,103 for cars, and £450 for costs incidental to the obtaining of the order.

Rhondda Valley.—Sir Douglas Fox has reported to the District Council on the routes of the proposed electric railway, and a committee has now been instructed to take the matter into consideration.

Saddleworth.—The authorities of Saddleworth, Springhead and Lees have appointed a joint committee to organise a scheme for connecting the whole district with a line of electric cars. It is estimated to cost between £70,000 and £100,000. The route will include Greenfield, Uppermill, Delph and Springhead, with Lydgate. A firm of Manchester engineers has offered to carry out the work entirely and work the system, the local councils to have the option of purchasing at a valuation at the end of 14 years. It is expected that such a system will cause a great exodus from Oldham, Ashton, and other centres to the country.

Sedgley.—Mr. Thomas Parker, Wolverhampton, has been appointed by the U.D.C. electrical expert to examine the new electric tramlines now in course of construction in the Council's district.

Sheffield.—In connection with the extensions which are being carried out at the Corporation tramways power station, there recently arrived in Sheffield the armature of a new generator, which will be the largest on the undertaking. Whereas the present sets have a power of 225 or 400 KW., the next will be 1,000 KW. Messrs. Cole, Marchant & Morley, of Bradford, are making the engine, while the British Thomson-Houston Company are supplying the electrical equipment. The armature was manufactured at their Berlin works. Its weight is 29 tons 12½ cwt. It was shipped to Goole, and from there had to be brought to Sheffield by canal. There was considerable trouble in getting the load on land, as the strongest crane at the Sheffield wharf has a capacity of only 5 tons. According to our local correspondent, a first venture was made on Wednesday last with an improvised tackle, but a hook broke, and the armature, which had been raised 3 ft., fell back into the boat. Elaborate preparations were made for a second effort on Thursday, but again a mishap occurred. When the case was almost clear of the barge edge a guy rope gave way, and the armature again went down. This time it fell on the side of the barge, which listed, filled with water and sank, and the armature went to the bottom of the canal!

Sierra Leone.—Mr. Chamberlain is in communication with the Governor of Sierra Leone, as to a scheme for the construction of a light railway in Sierra Leone from Freetown to the adjacent hills. Major Ross has strongly recommended the construction of an overhead electric tramway, similar to that in use at Teneriffe. Such a railway would be invaluable from the point of view of the health of the business community of Sierra Leone.

Sunderland.—The accounts of the borough accountant, which have just been issued, contain some interesting information as to that town's municipal electrical ventures. The old tramways company's undertaking—with horse traction—was bought for £35,000, and there was further paid in respect to the old system £8,500. The purchases of electric cars and instruments cost £15,258, and the construction of the permanent way and the overhead equipment cost £96,320. It is satisfactory to note that although the horse trams were run most of the time at a considerable loss, so well have the electrical trams done, that the debt once existing has been wiped off, and a credit balance of £4,757 carried forward, after paying £3,930 as interest, and £2,915 to the sinking fund. The report concludes with the statement that with 13 miles of single track, there was a car mileage of 496,952, and 6,294,888 passengers were carried, at an average cost of 11½d. per car mile, the average revenue being 1s. 1½d. per car mile. The capital expenditure on electric lighting up to the end of March last was £122,433; of this amount £15,365 had been spent on buildings, £48,637 on machinery, £44,537 on mains and services, £1,629 transformers and motors, £5,562 on meters, and £1,333 on electrical instruments. At a cost of £9,272, 1,331,844 B.T. units had been generated; of this 83,192 had been used in lighting public lamps, 256,240 units for the tramways, 879,336 for private consumers, and there was lost in distribution 55,608. The sale of current realised £15,441, and public lighting brought in £718. There was a net profit balance carried forward of £1,257.

Taunton.—The Electric Tramway Company's system was inspected on Thursday last week by Colonel von Donop, R.E., on behalf of the B. of T. Mr. F. J. S. Hosken has been appointed engineer to the new system.

Tokyo.—The Tokyo Electric Railway Company is about to let a contract to American manufacturers for the equipment of the new railway system of Japan's capital. There will be three 1,200-KW. polyphase generators, which will furnish current to substation rotary converters for transformation to direct current. The municipality has required the use of the double trolley.

Wimbledon.—Details of the London United Tramways scheme for the Wimbledon district are now forthcoming. It is proposed to connect the company's authorised line at Malden with the L.C.C.'s lines at Tooting, *vid* Coombe Hill, Worple Road, across the Wimbledon Station bridge, Wimbledon Broadway and High Street, Merton. Southerly, there is ultimately designed to be an extension to Ewell and Epsom.

TELEGRAPH AND TELEPHONE NOTES.

Australian Cable Extension.—The ss. *Anglia* left the Thames last week with the Mauritius—Rodriquez—Cocos sections of the Cape-Australian cable, and another steamer sailed on Saturday with the Cocos—Perth section. It is expected that all the above sections will be laid and opened for traffic before the end of October next, and that the final section between Perth and Adelaide will be completed early next year.

Cambridge.—It is proposed to establish a municipal telephone system in Cambridge.

Grantham.—The T.C. has decided to establish within the borough a municipal telephone system, which will have the advantage of giving to subscribers within a radius of one mile of the Town Hall an unlimited local service and a trunk line service at charges from 25 to 50 per cent. below the rates of the National Telephone Company, who opened an exchange in the town about 18 or 20 months since. It is proposed to place the municipal telephone in direct communication with the Central Trunk system at Nottingham, and thus easy calls may be made all over the country. Lines will also be extended to Belvoir and Buckminster, and it is hoped that other villages in the district will shortly be placed in telephonic communication with the borough. The Town Council is applying to the Local Government Board for permission to borrow £2,000 for the purpose of establishing the exchange.

Manchester Telephones.—The Telephones Committee of the Corporation last week further consdered the draft scheme for a joint board to operate over the Manchester telephone area, which board is to consist of 10 members of the City Council, five members of the Salford Corporation, and three members of the Eccles Corporation and Urban District Councils within the Man-

chester telephone area, acting jointly. The scheme provides that at the end of 10 years there may be a revision of its terms. A report, presented by the Town Clerk, upon the proceedings of the Committee up to date was adopted, together with a resolution that in the opinion of the Committee the scheme, as presented, is practicable, and that it is desirable that effect should be given to it without unnecessary delay.

Pacific Cable.—Replying to a question in the House of Commons regarding the contract for the Pacific Cable, the Chancellor of the Exchequer remarked that unless the contract had been accepted when it was, a considerable loss would have been incurred due to the rise in price of materials.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899 ..	..
Para-Maranham	March 1, 1900 ..	..
Cayenne-Pinheiro	April 20, 1901 ..	..
Basseterre-Les Saintes	June 29, 1901 ..	..
Nase-Keelung (Formosa)	Aug. 2, 1901 ..	..
Cadiz-Teneriffe	Aug. 6, 1901 ..	..
Bissao-Bolama	Aug. 16, 1901 ..	..
Landlines :—		
"*Via* Hanekin" on Persian territory ..	Feb. 24, 1900 ..	..
Pekin-Kalgan	June 14, 1900 ..	..
Malmatchin-Kalgan	June 30, 1900 ..	..
Communication with Baranquilla and Cartagena	Dec. 8, 1900 ..	..
" towns of Venezuela ..	Oct. 31, 1900 ..	..

Telegraphs.—The House of Commons has approved of the agreement made June 22nd, 1901, between his Majesty's Government and the Eastern Telegraph Company, Limited, for the construction, maintenance, and working of a submarine cable between Sierra Leone and Ascension. The House has also approved of the agreement made July 27th, 1901, between his Majesty's Government, the Governments of Cape Colony and Natal, the British South African Company, and the Eastern and the Eastern and South African Telegraph Companies for the transmission of telegraphic traffic to and from South Africa.

Wireless Telegraphy. — The *Lucania*, which left Liverpool on the 10th inst. for New York, was spoken by wireless telegraphy at Nantucket Lightship shortly after 6 p.m. on Friday last. Messages were received on the lightship from the *Lucania*, and then transmitted 40 miles to Siasconset, on Nantucket Island. On reaching port the officers of the *Lucania* reported that the messages from Nantucket were undecipherable aboard ship.

CONTRACTS OPEN AND CLOSED.

OPEN.

Amsterdam.—September 2nd. Tenders are invited by the Municipality of Amsterdam for the supply of electric cars, 5,000 tons of rails, &c. Director of the Municipal Tramways, Nieuwe Achtergracht, No. 164, Amsterdam.

Aston Manor.—September 4th. Water-tube boilers, 200-kw. and 500-kw. steam dynamos, balancer, switchboard, crane, and arc lamps for the D.C. electricity works. See "Official Notices" August 9th.

Aston Manor.—September 4th. Pipework, fitters' shop and cables for the municipal electricity works. See "Official Notices" August 16th.

Batley.—September 14th. The Corporation is advertising for tenders for all materials for the permanent way of 3½ miles of electric tramway in the borough.

Belfast.—August 30th. Cast-iron frames and covers, pipes, and bell mouth ends for the municipal electricity department. See "Official Notices" August 16th.

Birkenhead.—August 23rd. The Corporation wants tenders for steam engine and dynamo for traction. See "Official Notices" August 9th.

Bournemouth.—August 29th. Boilers, superheaters, economiser, feed pumps, pipework, &c., for the T.C's tramways power station. See "Official Notices" August 9th.

Bournemouth.—August 31st. Tenders for water cooler and travelling crane for the Corporation tramway station. See "Official Notices" August 16th.

Bournemouth.—September 16th. The Town Council wants tenders for tramway rails, permanent way construction and rail bonding, and paving. See "Official Notices" to-day.

Croydon.—August 26th. The electric wiring and fitting of the Lunatic Asylum, Warlingham, Surrey. See "Official Notices" August 2nd.

Doncaster.—August 31st. The Corporation invites tenders for the supply and erection of a tramway switchboard. See "Official Notices" to-day.

Dundee.—September 14th. The T.C. invites tenders for overhead equipment for new tramway routes. See "Official Notices" to-day.

Edinburgh.—September 9th. For the electric lighting installation for the second portion of the Colinton Mains Fever Hospital (800 points), for the Corporation. See "Official Notices" August 9th.

Egypt.—September 15th. According to the *Board of Trade Journal* the Local Committee at Fayoum have decided to instal the electric light in the town. Persons wishing to tender can obtain the conditions of contract from the Minister of Public Works at Cairo.

France.—August 30th. Tenders are being invited until the 30th inst. by the French Post and Telegraph authorities in Paris, for the supply of 420,000 porcelain insulators. Tenders are to be sent to Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris, whence particulars may be obtained.

Fulham.—August 28th. The electric lighting of the Fulham Road Workhouse Chapel. See "Official Notices" August 16th.

Glamorgan.—August 24th. For the lighting by electricity of Parc Gwyllt Asylum, near Bridgend. See "Official Notices" August 2nd.

Glasgow.—August 30th. The Corporation wants offers for the supply, delivery, and erection, complete, of the overhead trolley constructional work required for the extension of the system. Mr. John Young, general manager, 88, Renfield Street, Glasgow. A Bank Draft for two guineas, with application for specification.

Kirkcaldy.—September 13th. The Corporation wants tenders for the supply and erection of overhead construction for electric tramways. See "Official Notices" to-day.

Leigh.—August 24th. A steam dynamo for the electricity works. See "Official Notices" August 9th.

Lowestoft.—September 9th. 500-kw. steam dynamo, switchboard panel, &c., for the municipal electricity works. See "Official Notices" August 16th.

Manchester.—August 24th. The Tramways Committee wants tenders for electrical accessories, machine tools, &c. See "Official Notices" August 16th.

Mansfield.—September 5th. Refuse destructors for the E.L. Committee. See "Official Notices" August 2nd.

Middlesbrough.—September 3rd. Mechanical coal-handling plant for the electricity works. See "Official Notices" August 2nd.

Newport (Mon.).—September 4th. Telephones, electric bells, &c., for the new workhouse. See "Official Notices" August 16th.

We may mention that Mr. A. Treyer Evans, electrical adviser to the Newport Board of Guardians, requires all tenders for the above to be sent in sharp on the above date.

Oldham.—September 10th. The Corporation wants tenders for two overhead electric travelling cranes. Particulars from Mr. A. Andrew, Gas and Water Offices, Oldham.

Oldham.—September 10th. Two electric travelling cranes for the Greenhill electricity works. See "Official Notices" August 16th.

Partick.—12 months' supply of arc lamp carbons, meters, demand indicators, and house fuse boxes for the T.C. See "Official' Notices" August 16th.

Southend-on-Sea.—September 7th. The Corporation wants tenders for supplying and laying electric lighting cables. See "Official Notices" to-day.

St. Annes.—August 23rd. A 180-kw. c.c. direct coupled steam dynamo for the Council. See "Official Notices" August 9th.

(Continued on page 315.)

EAST HAM ELECTRIC TRAMWAYS.

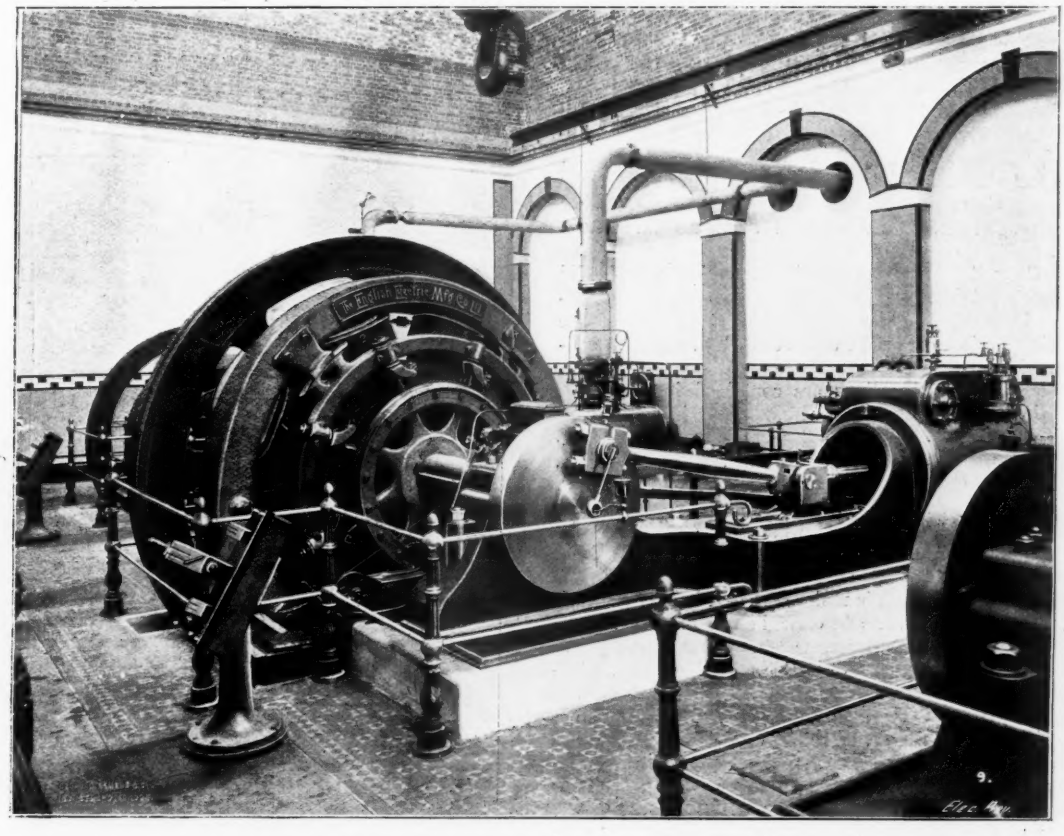
The district of East Ham ten years ago was but a village on the outskirts of London; now it has a population of 95,000—an increase of nearly 200 per cent. within that period—and possesses the distinction of being the first of the

Front View of Works and Car Sheds.

Metropolitan suburban municipalities to provide for its residents an up-to-date system of both electric lighting and traction. Such a shining light in the darkness of the East End, as yet almost unvisited by the private tramway company promoter, cannot fail to stimulate the neighbouring local authorities to carry on the good work, and to emulate this enterprising municipality in its regard for the public welfare.

The District Council of East Ham obtained Parliamentary sanction in 1898 for the equipment of the district with a system of electric lighting; powers were also obtained for the construction of the first sections of the electric tramways in the district, the total length of line arranged for being $1\frac{1}{2}$ miles of double track and $2\frac{1}{8}$ miles of single track, with passing places at frequent intervals. In 1900 further powers were obtained for extensions of the tramways, amounting to $\frac{3}{4}$ mile of double track, and $4\frac{3}{4}$ miles of single track, making a total length of $9\frac{1}{8}$ miles of line. Of this amount $4\frac{1}{2}$ miles have been completed, and the remainder will be constructed as soon as possible.

In February, 1899, the Council obtained the services of Mr. Wm. C. Ullmann, M.I.E.E., as their resident and consulting electrical engineer, authorising him to prepare a complete scheme for carrying out the works under the powers obtained. In April of the same year Mr. Ullmann presented his report, recommending the Council to adopt a combined system suitable for the working of both the lighting and tramway schemes. The estimated expenditure for the first section of the combined schemes was, for the tramways £47,760, and for the lighting £41,428. A further estimated expenditure in connection with the Tramways Extension Order of 1900, to the extent of £42,220, has since been granted, together with £6,540 for extensions of lighting cables, and £2,645 for building extensions, making a total estimated expenditure of £140,593.

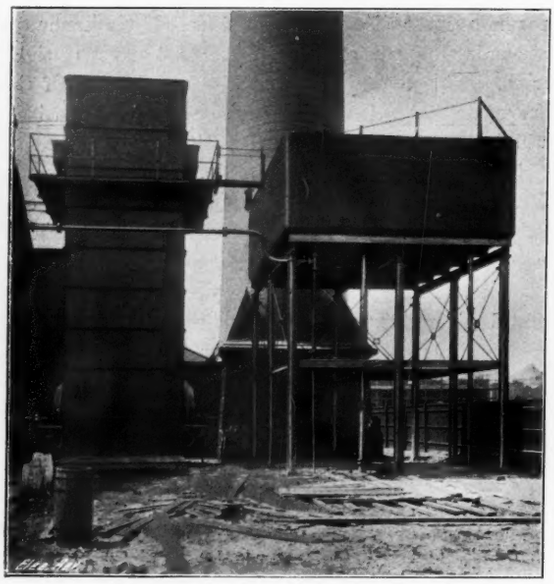


English Electric 225-kw. Generator and Musgrave Engine.

The report was unanimously adopted by the Council, and Mr. Ullmann was instructed to proceed at once with the preparation of specifications and plans, and to make all the necessary preliminary arrangements for carrying out the work.

F

In September, 1899, tenders were accepted for the following contracts :—Messrs. Dick, Kerr & Co., Limited, for the construction of the whole of the permanent way under the 1898 Order, together with the complete equipment of the overhead lines, engines, generators, balancers, booster, motor



Cooling Tower and Storage Tank.

cars, switchboard, feeder cables, &c., also for further extensions of permanent way, under the 1900 Order ; Callender's Cable and Construction Company, Limited, for the supplying and laying of the whole of the electric lighting cables, also for the feeder cables, feeder and section boxes for Messrs. Dick, Kerr & Co.'s contract ; Messrs. Babcock & Wilcox for the complete equipment of the boiler house, supplying and erecting the boilers, condensers, cooling tower, storage tank, and the whole of the steam and exhaust piping.

The Council were fortunate in possessing a splendid building site, right in the centre of the district, where sufficient land was found to be available for the building of the generating station, car sheds, coal stores, and offices in connection with the scheme.

The whole of the buildings are contained in one block, and, with the exception of the chimney and iron roof construction, have been carried out by the Council's works department, under the supervision of Mr. A. H. Campbell, M.I.C.E., the Council's engineer and surveyor, and Mr. W. H. Savage, A.M.I.C.E., consulting surveyor to the Council. The iron and steel work was carried out by Messrs. Pierson & Co., and the chimney by Messrs. Wilson Bros.

The main engine room is under one bay, having a length of 177 ft., width 42 ft., and clear height of 26 ft. The principal offices of the department are most conveniently arranged at the southern end of the engine room, while workshops and men's mess rooms are provided at the northern end, outside the main building. A 20-ton traveller, supplied by Messrs. Dick, Kerr & Co., runs through the length of the building. The walls are lined with opalite tiling up to the level of the travelling girders. Adjoining the engine room is the boiler house, 148 ft. long, 46 ft. wide × 22 ft. 6 in. clear height, having a main flue 12 ft. high × 6 ft. 3 in. wide. The coal bunkers run parallel with the boiler house, having access in front of each boiler.

The boiler house has sufficient accommodation for boilers equal to generating steam for 3,000 H.P. The chimney is circular, 135 ft. high, with an internal diameter of 9 ft. 6 in. A feature of the boiler house is the artesian well, 13½ in. diameter, bored to a depth of 500 ft., which, when completed, is expected to yield 12,000 gallons of water per hour.

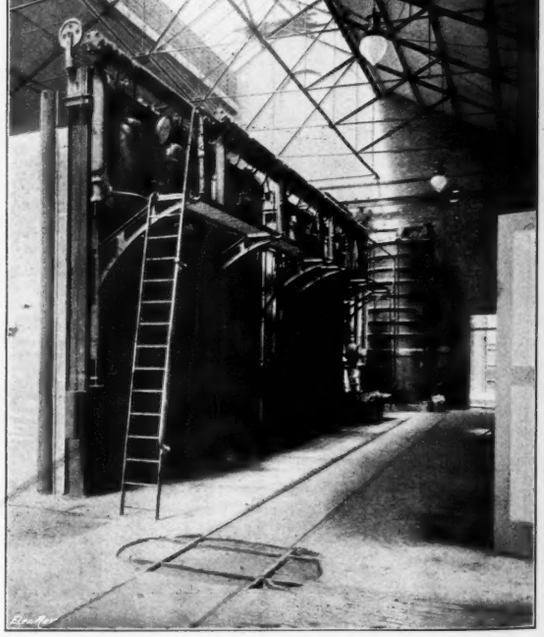
On the opposite side of the engine room is the car depôt, having a length of 148 ft., and total width of 65 ft. Accommodation is provided for 25 motor cars, with the necessary arrangements for cleaning, repairing, &c. In the car shed are also offices for the traffic staff and rooms for inspectors, motormen, and conductors.

The boiler house at present contains four Babcock and Wilcox single boilers, each having a heating surface of 3,580 sq. ft., and capable of evaporating 10,000 lbs. of water per hour at 150 lbs. pressure. Babcock & Wilcox superheaters are fitted to each boiler. A "Boby" patent heater detartariser is also supplied, capable of heating and purifying 3,000 gallons of water per hour. The boiler feed pumps are of the Blake simplex Admiralty type, arranged to work as two entirely separate pumps, or as one compound, if required. A Barnard Wheeler cooling tower is also provided for dealing with the circulating water when condensing.

For the engine room Messrs. Babcock & Wilcox have supplied two Wheeler condensers with combined air and circulating pumps, so arranged as to be available for any one or two of the sets which may be running.

The whole of the generating plant is arranged so as to be available for either traction or lighting purposes. The plant at present installed consists of one 100-KW. generator coupled direct to a 150-I.H.P. engine, and three 225-KW. generators coupled direct to 350-I.H.P. engines. The engines supplied by the contractors for the power house equipment were made by Messrs. Musgrave & Sons, of Bolton, and are of the horizontal cross-compound type, having an ordinary piston valve controlled by an automatic crankshaft governor on the high pressure side, while the low pressure side is fitted with Corliss valve gear. The 150-H.P. engine has cylinders of 9 in. and 18 in. diameter with 24-in. stroke, running at a speed of 150 revolutions. The 350-H.P. engines have cylinders of 13½ in. and 27½ in. with 27-in. stroke, and run at 135 revolutions per minute.

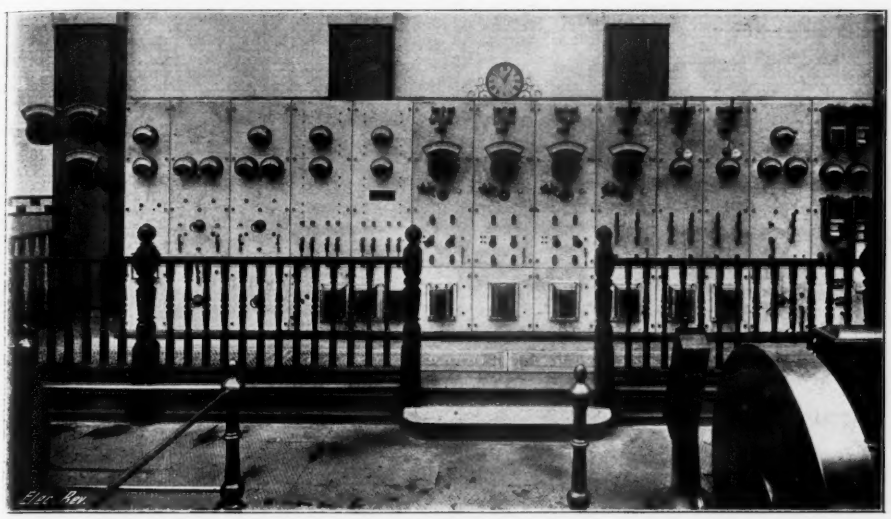
The generators were manufactured by the English Electric Manufacturing Company, of Preston (for whom Messrs.



View of Boilers.

Dick, Kerr & Co. are the sole selling agents) and are of the multipolar type. When used for traction purposes they work as compound-wound generators, with a variation of from 500 to 550 volts ; when used for lighting they are run as shunt wound generators, a rheostat being provided of

sufficient range to enable the voltage to be varied between the limits of 480 and 580 volts. The armatures are of the slotted type, drum wound with interchangeable coils, and special ventilating ducts are provided to ensure a low temperature rise.



Main Switchboard.

As a considerable amount of the traction current will return through the single track, a 0·3 insulated copper conductor is laid parallel to this section of the line, and a booster is provided in order to keep the fall of pressure along the rail within safe limits.

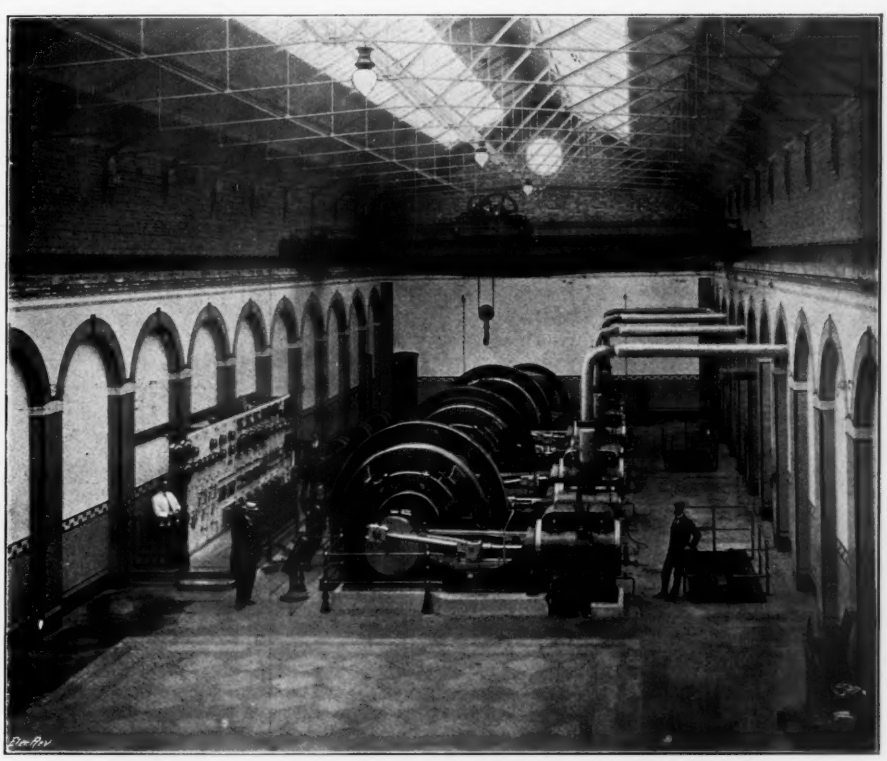
For the three-wire lighting mains two balancers are provided, each consisting of two similar generators coupled together and mounted on a common bedplate. Each machine is capable of dealing with an out-of-balance current of 100 amperes.

The main switchboard consists of 13 panels of white marble mounted on a raised platform, and was made by the English Electric Manufacturing Company, Limited. It is composed of four generator panels, two balancer, two lighting feeder, two traction feeder, one station lighting, one booster, and one Board of Trade panel, with all the usual switches, instruments, &c.

The district of East Ham is remarkable for its flatness, there being scarcely any gradients whatever, excepting at places where the track crosses the railway lines, and the main North Metropolitan sewer. The gauge is 4 ft. 8½ in. No curves are of less than 40 ft. radius. The whole of the track is laid with 87-lb. rails, double-bonded throughout, with 0000 S.W.G. Neptune bonds. Askham Bros. and Wilson's cast-steel points are used throughout. The double track is laid upon a continuous bed of cement concrete, 6 in. thick, paved throughout to a distance of 18 in. outside the rails with granite setts, while in the single track the rails are laid on a continuous bed of concrete 18 in. wide × 9 in. thick, the surface being paved with granite setts 9 in. on each side of the rails, and the centre filled in with tarred macadam.

The whole of the conduits used for both lighting and traction feeders are laid in the centre beneath the permanent way. The conduits used for the feeder system are "Sykes" patent, with self-centreing Stanford joints. These are laid in concrete, with draw-in boxes placed at intervals of about 100 yards.

The overhead line consists entirely of side pole and bracket construction, the maximum length of any bracket being 18 ft. The poles, which are of the telescope joint type, are known as the No. 3 and No. 4 pole, the No. 3 having a length of 31 ft., weighing, without the base, 990 lbs., while No. 4 is of the same length, with a weight of 1,321 lbs. The trolley wires are No. 0 B. and S. gauge, tested to an actual breaking stress equal to 27·3 tons per sq. in. The pole bases are of the type adopted by Messrs. Dick, Kerr and Co., who are the contractors for this work.

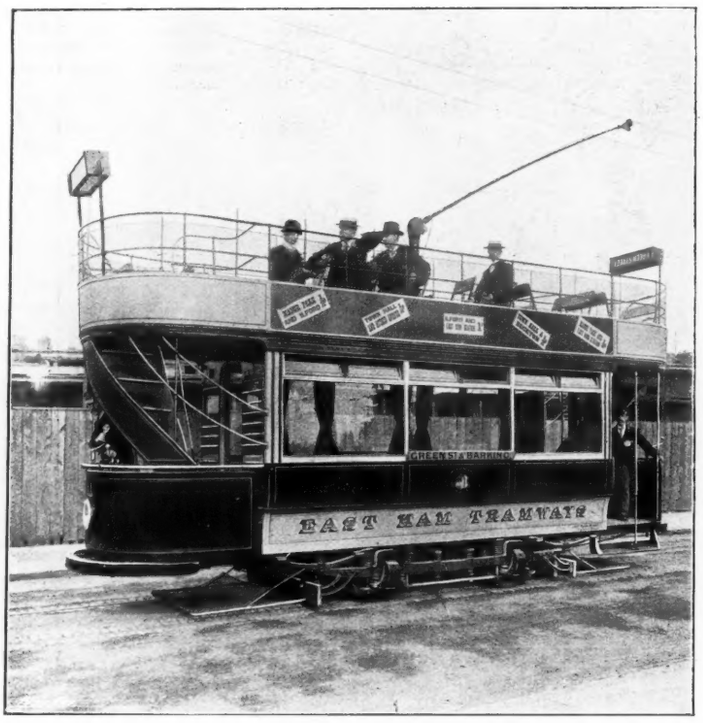


General View of Engine Room.

A novel feature of the overhead construction is that the street arc lamps are suspended from the bracket arms, in a position so as to be as near to the centre of the street as possible. In connection with the street lighting, arrangements have been made to light the whole of the tramway route with arc lamps of Messrs. Johnson & Phillips's "Ark"

type; altogether 135 arcs will be used in the main thoroughfares. The lamps are run in series of five, connected across the outers of the three-wire distribution mains, each lamp being provided with a switch and substitution resistance to enable any single lamp to be cut out while on circuit.

These lamps are of the enclosed long-burning type, taking a current of 5 amperes; there is no upper carbon holder, the current being conveyed direct to the upper carbon by means of four copper contact pieces F (see figure), which are held against the carbon rod by gravity, turning about pins in the contact frame A. When current passes through the solenoid B, exciting the fixed internal pole-piece C, the armature D is slightly raised, allowing the four clutch cams which are connected with it by the pins E to grip the carbon and strike the arc. As the carbons burn away the armature gradually descends, until the clutches are momentarily released, and the carbon rod slips through and feeds. The contact pieces F are placed inside the dashpot, and are so arranged that they engage in a groove in the positive carbon and cut out the lamp when the carbons have burnt to a certain extent.



View of "Liverpool" Car.

themselves enables a considerable economy to be effected: the use of separate poles in this case would have entailed an additional outlay of nearly £4,000. The lamps burn perfectly, in spite of the vibrations due to passing cars, without even the use of spring suspensions.

The lamps are mounted on alternate poles, about 80 yards apart, as shown in the view of Barking Road; another view shows the appearance of the road at midnight, illuminated with these lamps.

The rolling stock at present provided on the tramways consists of 15 top seat cars, known as the Liverpool type, having the "Bellamy" reversed stairway. These cars were supplied by Messrs. Dick, Kerr & Co. from the Electric Tramway and Carriage Works at Preston. Each car is mounted on a Brill 21 E truck, and has a seating capacity of 56 passengers, 22 inside and 34 outside. Each car has two motors of the 25 A type, designed to give a tractive effort of not less than 1,000 lbs. when running at 10 miles per hour. The cars have illuminated destination boards at each end above the top of the upper deck.

The controllers, like the motors, are of the well-known

Barking Road, Showing Overhead Construction and Arc Lamps.

Barking Road at Midnight.

The bright horizontal streaks are caused by the headlights of tramcars; the fainter ones by the lights on ordinary vehicles.

The frame of the lamp is in one piece, ensuring great strength and rigidity, which, added to the simplicity of the mechanism, and the corresponding cheapness of production, are special features of the lamp.

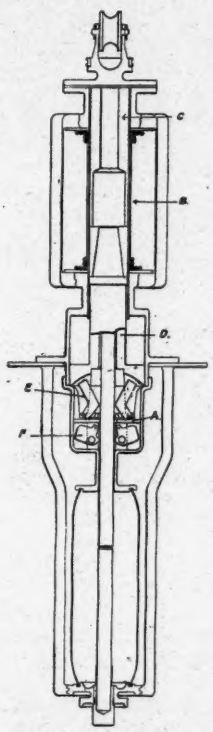
The device of suspending the lamps from the brackets

"Short" design, with solenoid blow-out and rheostatic brake, capable of controlling the car in any emergency.

The cars, which are of a type shown by Messrs. Dick, Kerr & Co. at the Tramways and Light Railways Exhibition in July last year, and which then attracted the attention of

the members of the Council, present a very handsome appearance. They embody features of improved roof construction, with the special provisions for ventilating sashes first introduced in tramway car construction by the Preston Company, which have now been adopted by practically all the great Corporations and companies in the United Kingdom. The reverse stairway and extra protection afforded to the motorman will no doubt be appreciated by the travelling public. The interior finish is in quartered oak throughout, the wood work, while not over elaborated in detail, being of a handsome and ornamental design.

The whole of the cables used in the district are of Messrs. Callender's make. The feeders, both for lighting and traction, are lead-covered single cables, insulated with fine-spun jute fibre, put on in several layers, each layer being thoroughly impregnated with fine prepared bitumen. The lead sheathing is covered with two servings of bitumen tape, laid in reversed directions and well compounded. The largest lighting feeders are 0·42 and the traction feeders 0·3 sq. in. in area. The total length of feeders laid at present



Section of "Ark" Lamp.

is 7·5 miles. The lighting distributor cables are laid throughout on Callender's solid system in wooden troughing filled with bitumen, and consist of three single cables, with a pressure of 480 volts betweeen the outers. A total length of 13 miles of distributors has been laid in the district. Three-core pilot and telephone cables are also laid to the extreme ends of the district for both lighting and traction purposes.

In carrying out the scheme the Council has not spared any necessary expense in order to make its undertaking a thorough success, and in order to popularise the tramways as much as possible, it has decided to institute ½d. stages right through the system.

It is gratifying to point out the fact that the cars and their equipment, as well as the boilers, engines, and generators—in fact, almost the entire electrical and mechanical equipment of the plant—are the product of British labour, and the output of British shops.

In conclusion, we have to express our thanks to Mr. W. C. Ullmann, who carried out the whole of the work, and to the contractors, for the information embodied in this article.

CONTRACTS OPEN AND CLOSED.

(*Continued from page* 310.)

Spain.—The Junta Local de Prisiones de Madrid, is inviting tenders until the 31st inst., for an installation of electric lighting in the Cellular Prison in Madrid, and for the working of the same. Particulars may be obtained from, and tenders are to be sent to, La Secretaria de la Junta Local de Prisiones de Madrid, at the Prision Celular, Madrid.

Sunderland.—August 30th. The Corporation wants tenders for wiring the new (Hylton Road) electricity works. See "Official Notices" to-day.

Torquay.—September 13th. The E.L. Committee invites tenders for the supply of arc lamp carbons for a period of 12 months from October 1st, 1901. See "Official Notices" to-day.

Walthamstow.—August 30th. The U.D.C. invites tenders for house wiring. See "Official Notices" to-day.

Willesden.—The D.C. wants tenders for the equipment of the proposed electricity works. See "Official Notices" August 2nd.

Worcester.—August 23rd. The Corporation wants tenders for water-tube boilers, economiser, pipes and pumps, steam dynamos, motor alternator and booster, Korting condensers, electric pumps, switchboard, crane, and battery for the new electricity works. See "Official Notices" July 26th.

CLOSED.

France.—The India-Rubber and Gutta-Percha Company, of Persan—Beaumont (Seine-et-Oise), has just secured a contract for a quantity of insulated telephone cable for the French Post and Telegraph authorities.

Glasgow.—Messrs. Davidson & Co., Limited, are to provide and fit up induced draught fans and motors for the Port Dundas electric power station at a cost of £1,714.

Gravesend.—The T.C. has provisionally accepted the following tenders for the new electricity works, on the advice of Mr. Trentham.

Sec. A. Boilers.—Babcock & Wilcox, Limited, £3,005, including automatic stoker.
Sec. B. Steam pipes.—Babcock & Wilcox, Limited, £2,296.
Secs. C. and D. Engines and dynamos.—The Lancashire Dynamo and Motor Company, Limited, £6,245.
Sec. E. Switchboard.—Messrs. Brooke, Hirst & Co., £830.
Sec. F. Cables and underground work.—The Western Electrical Company, £7,220, including maintenance for seven years.
Sec. G. Accumulators.—Veritys, Limited. Pritchett accumulators, and cables, £1,677, including maintenance for two years free, and afterwards an additional payment of £80 for five years maintenance.
Sec. I. Travelling crane.—James Carrick & Sons, Limited, £219.
Sec. K. Artesian well.—Isler & Co., Limited, £310, less 22s. for every foot under 100 ft. in depth.

Liverpool.—Mr. A. Bromley Holmes, city electrical engineer, having recently made a report to the Electric Power and Lighting Committee of the Corporation, with respect to the formation of an electric generating station at the refuse destructor works in Charters Street, the Committee has recommended that the tender of Messrs. Willans & Robinson, Rugby, to supply four steam dynamos, at the price mentioned in their tender, be accepted.

Mansfield.—The T.C. has accepted the following tenders for generating plant and mains:—Section A, J. Musgrave & Sons; B, Thomas Parker, Limited (subject to guarantee as to steam consumption); C, Johnson & Phillips; D, Bertram Thomas; E, Tudor Accumulator Company, Limited; F, Carrick & Ritchie; G, Western Electric Company, Limited; H, Gilbert Arc Lamp Company, Limited; I, Chamberlain & Hookham; K, Britannia Company.

West Ham.—The Lighting and Tramways Committee at their meeting on Friday last, on the advice of Mr. J. K. Bock, borough electrical engineer, decided to accept the tender of Messrs. Babcock & Wilcox in the sum of £14,720 for the supply of 11 water-tube boilers.

FORTHCOMING EVENTS.

Tuesday, Wednesday and Thursday, September 3rd, 4th and 5th.—The International Engineering Congress at Glasgow. For details of papers, &c., see Electrical Review "Notes," August 9th.

Wednesday, September 11th to 18th.—Glasgow. Annual Congress of the British Association for the Advancement of Science.

NOTES.

A Field for English Enterprise.—John Grant's Directory and Argentine Commercial Guide for 1901—1902 contains some interesting information on the imports of electrical goods into Argentina. From the year 1895 to 1899 Germany supplied 210 dynamos, Belgium 52, United States 390, France 21, and England 123. During the year 1899 the respective figures for the five nations were as follows: 150, 41, 356, 5, and 106. In 1900 the number imported was 648, but the proportion amongst those who supplied is not stated. In insulated wire and cables Belgium is an easy first, England second, and Germany third; but in arc lamp carbons and incandescent lamps the old country makes but a poor showing, even Italy standing ahead of us in the export of lamps to Argentina. In telephone material we are slightly in advance of Germany, but a very long way behind Belgium, and the only instance in which England stands right away from her competitors is in telegraph material. During the past few years electrical industries have made great developments in Argentina, especially in Buenos Ayres, and it is easy to see that there is a great field for English makers of dynamos, cables, incandescent lamps, and telephone material, together with meters and bells, if the business is only pushed home. We ought in the near future to gather into our own coffers a much greater percentage of the hundreds of thousands of dollars now being carried off by Germany, Belgium and America.

Direct Current Engineering Practice in Germany.—Writing on this subject in the *Electrical World*, Mr. Charles Brandeis says that while in America compound-wound dynamos are in universal use, this is very rarely the case in Germany, especially for lighting purposes. This is explained by the fact that the engineers in Germany favour the use of storage batteries working in parallel with the generators, because of the advantages they have in assisting the latter during the peak of the load, and enabling the entire steam plant to be shut down during light loads without interruption of the service. Thus the steam engines can always be worked at full load, and consequently with high average efficiency. Moreover, the storage battery ensures constancy of bus-bar pressure, and makes the latter more independent of the generator voltage fluctuations. According to published statistics, there were in Germany, up to March 1st, 1900, 652 central stations in operation, of which 568 had direct current systems, and of these only 43 are operated without storage batteries. Since compound-wound dynamos are not suitable for storage systems, the result is that shunt-wound machines are most widely in use, the former being rarely used even for street railway work. Thus German engineering practice is entirely different from that of America.

Æsthetics as a Factor in Trade Competition.—Continental business methods are now attracting a good deal of attention, as well as some criticism. While the advantages of the cleanliness of the Continental works are indisputable, the wisdom of the somewhat lavish expenditure of capital, which is so much in evidence, is open to question. It is urged—and we agree—that English firms, for financial reasons, would be ill-advised to follow on similar lines; that much capital on the Continent is spent on mere ornamentation; and the present slump felt among Continental firms is by some attributed, at least in part, to this. But is the extra capital outlay on the "ornamental" part so enormous a percentage of the whole? Is not the present depression due to the too many and too large concerns? In raising these questions, one of our contributors points out that it must not be forgotten that the so-called ornamentation is part of the whole, and in the opinion of the Continental expert, inseparable; he believes in his works, &c., being clean, and gives his men something worth keeping clean. "Though to the English engineer used to Sheffield and other cities of delight, the luxury of the typical Continental works seems a matter of secondary importance, and often invokes his sarcasm, it may well have a more important influence than appears at first sight. Competition for large orders is increasing, and anything that is likely to influence the buyer is at least worthy of consideration. An enormous electric trade is being done with such countries as Russia, Japan, &c., men being sent to buy who have not been trained to the sight of English workshops, and who are, after all, human. Let us look at the question from such a buyer's point of view, say, on a tour round the Continent and in England. On the Continent he will visit all the largest works, and will experience similar hospitality to that shown to the Institution on their recent visit to Germany, which means a great deal. He receives every attention, and all inquiries are answered, not only verbally but often by practical demonstration. This attentiveness and trouble is characteristic. He sees in the manufactories and central stations the most up-to-date machinery, and with it all the cleanliness and effect which is so much in evidence. Is it to be wondered at that the *tout ensemble* impresses him, and, as in many other matters, does not the outward and visible count as a factor in producing this effect? He has no reason to suppose this showiness is at the expense of good workmanship, but rather regards it as good management, while the prices of the machines do not act as an antidote. In short, he goes away in most cases in a pleased frame of mind, which is often nine-tenths of an order. So much for the Continent. In England he finds us still resting on the reputation we have made in the past. Are English works calculated to impress him, and does he receive similar treatment to that which he did on the Continent? and, lastly, is he in consequence likely to leave an order behind him? Are not English firms often wanting in smartness and push, and are not deliveries often late? Another point Englishmen are very lacking in, and that is languages. It is naturally more agreeable for a buyer of machinery to correspond in his own language, and this can be done with Continental firms far more readily than with English. The greater majority of engineers, &c., on the Continent have at least a reading knowledge of English, and many can speak it as well. More than one consul has pointed out the advisability of publishing price list dimensions in both the English and the metric system, and this would involve but trifling expenditure compared with the advantages gained." It is well to look at every side of the question, and we commend these views to the consideration of British manufacturers.

Belleville Boilers in the Navy.—But recently it was M. Belleville himself, now it is M. Louis Marcel, of Paris, who has entered the lists in favour of the Belleville bubble in the shape of a letter to the *Times*. M. Marcel avers that the French navy continues to fit Bellevilles, and so, he says, do the other navies. We believe he is wrong as regards France. Germany has abandoned further effort, and America condemned the boiler from a drawing, which, of course, it was easy to do, for the faults are obvious. It may and will raise steam, but any minute one or some of its lower tubes may become red hot, and when tubes are often becoming red hot they are liable to fail any subsequent moment. M. Louis Marcel, of Paris, who is so anxious to do England a service, would be better employed advocating boilers for the French navy. He might have them made of old salmon tins. We trust there will yet be found some one in authority in this country who is strong enough to put the final stop on whatever influence is at work to foist the Belleville boiler any further upon us.

Sauce for the Goose.—It is amusing to note the stand taken by Americans on the protection question when there are suggestions to protect against America. At this moment Americans are worried because there is talk of a European combination to treat the U.S. exactly as the U.S. treats Europe. Whenever this tariff subject is broached, Americans become ridiculous. Thus the *American Machinist* twits Europeans with ignorance of America's vast size and great diversity of soil, climate and resources. This is sheer rubbish. Europe alone is practically of the same area as the United States. Like the United States it has a wide range of climate from the sub-arctic of the North Cape to the semi-tropical of Sicily. It has equal diversity of soil and resources, and at least three of the States of Europe have extra—European areas larger, in two cases several fold larger, than the U.S., and of infinitely wider range of climate and production. It is odd that Americans who have been so mad in their tariff mongering should be annoyed when the same madness breaks out in others. Europe can just as well afford the folly of protection as can the United States. The United States is large, and largely self-contained, but Americans become singularly and amusingly irritated when it is proposed they should be taken at their own valuation, and asked to become a world unto themselves, as the *American Machinist* boasts they are. Yet our contemporary publishes an English edition to push America in Europe, and so gives the lie to its own boast. Its article concludes with a pious expression of opinion that European legislators require educating to a sense of the folly of protection!! So far as England is concerned, all foreigners are tarred with the same brush, and yet they all tumble over each other to sell goods in England, and if they cannot sell at a profit many give them away under cost. The largest export trade of any country is done, we believe, by Great Britain, and yet if the citizens of some of these countries had their wish they would ruin their best customer to oblige the arm-chair martyr of Hilversum. Even the American papers in the same breath are never tiring of shouting ruin to English trade and urging Americans to come here and sell. Fancy trying to drive a trade with a man while endeavouring to put him in the Bankruptcy Court. Truly a marvellous people and marvellous papers to split hairs on such a question as protection.

Central London Railway.—The experiments which have for some time been in progress with a view to the reduction of vibration are so far satisfactory. A geared locomotive weighing only 31 tons as against 42 tons in the present ones has been successfully operated, and a multiple unit train is now under trial. Apart from the reduction of vibration, a notable decrease in weight is likely to be effected.

Electric Traction on the Vienna "Stadtbahn."—Some very interesting trials are now being carried out on the Heiligenstadt—Michelbeuern section of the Vienna Stadtbahn. This section is about 2·4 miles long, and has an average gradient of 8 per cent., with curves aggregating about one mile. The two intermediate stations, Nussdorferstrasse and Wachringerstrasse, divide this line into three parts, two of which are only about 0·44 mile in length. On account of a frequent service of steam trains during the larger part of the day, the electric traction trials have to be conducted in the small hours of the morning. The line being, to a large extent, conducted in cuttings and on arches and girder bridges, the object of the trials was not so much to demonstrate the feasibility of removing the smoke nuisance as to establish the economy and reliability of electric traction in general, and to find the most suitable system under the prevailing conditions of the line and of the traffic. It is, of course, essential that the proposed systems should be installed and worked without interfering with the traffic of the line, which carries not only passengers but also goods, principally from the Western Railway terminus to the Danube transit station, to the Northern Railway terminus and *vice versâ*. Ministerialrat von Leber, who presides over the Governmental Department which controls this line, arranged all details of these trials with Messrs. Siemens and Halske, of Vienna, and decided in favour of the multiple unit system and of shunt-wound motors. Each train consists of one or two groups of four cars, each of which is equipped with one motor, which drives one of the two car axles direct. The front and rear compartments of the train serve as drivers' cabins, and are provided with controllers of peculiar construction. They can either be worked by hand or made to copy the leading controller's action by means of an auxiliary motor. The controllers of the intermediate cars can only be worked by these motors. This system has the advantage of considerably reducing the number of cables which run through the train, which is a point of great importance on a line where the composition of trains is frequently altered. The auxiliary motors are controlled by electro-magnets, and are said to answer well, and to distribute the load evenly over all the traction motors on the train. The advantage of shunt-wound over series-wound motors consists in being able to dispense almost entirely with mechanical brakes and in economising current by working the motors as generators. The trains which are braked in this way supply current to others just starting or climbing gradients. Another advantage claimed is the saving of tires from the action of brake blocks. As there are frequent gradients on this circle line, some amounting to 20 per cent., this economy proves of importance. Braking is also possible by reversing the current, and by means of a continuous-acting low pressure air brake with which the trains are provided. The reservoirs of these brakes are filled by means of electric pumps mounted on the trains. The arrangements for supplying 500-volt current to the trains are similar to those in use on the Liverpool Overhead Ry. and the City and South London Ry. The contact rail is placed between the ordinary rails, and stands about 1⅛ in. higher in order to prevent short circuits at crossings. Each car is provided with a slider, but some of the crossings are so wide that only two of these sliders remain in action. Every detail is said to have acted well during the trials, which are to be continued. The trains can be started and stopped quickly and smoothly, and it is expected that this system will be adopted all over this extensive, and in many ways very interesting, city line.

Electrocution.—Our New York contemporaries have now and again to discuss the electrocution of criminals. The views of our namesake as to such "inhumane" treatment we quoted a few weeks ago. Another view is given by the *American Electrician* in the following editorial terms:—"At intervals about as erratic as the arguments presented, publications of various classes break out in tirades against the use of electricity for the execution of murderers; even members of the technical press have indulged in mawkish twaddle anent the 'inhumane' character of this method. This application of electricity is, of course, repugnant to the sensibilities of those engaged in more attractive branches of electrical work, but it seems the extreme of cant to oppose electrocution on the ground of a bare possibility that it may not be entirely soothing and restful to the nerves of a wretch who has manifested a disregard for human life."

Life in the Old Dog Yet.—The prevalent idea that the United Kingdom is rapidly following Jack and Jill down the hill, says the *Age of Steel*, is not endorsed by the late United States Consul in Birmingham. He has a strong opinion to the contrary, and in reference to the iron and steel trades says:—"Disabuse your mind of the idea that England is going to lie down, and that it is not in the race. The country is not having commercial ague, but is going along in the old sure way. The great American steel combine is regarded by some with fear, but the wise-thinking and practical men as a rule regard this gigantic consolidation as an exaggerated shadow on the horizon, so far as Great Britain is concerned. The country was never more busy, and higher wages are being paid than ever before. Have no fear of her going down, at least for a week."

Personal.—Mr. H. Brewer-Noble, of Shepherd's Bush, has been appointed mains superintendent to the Hastings Corporation.

Mr. Clifton Robinson, jun., superintendent of the London United Tramways, will shortly attain his 21st birthday, and has been invited to a repast by the staff of the company to celebrate the occasion.

Mr. James Paxman, senior partner of Messrs. Davey, Paxman & Co., sails to-morrow on a visit to the United States of America, accompanied by his London manager, Mr. T. H. Harrison.

A Lightning Arrester! — "Riddles are popular at present. Will the *Electrical Engineer* explain what it means by a "a leakage of fifty degrees"? The phrase occurs in an article on "Telegraph Engineers" in the current number with reference to certain African land lines. I suggest as a possible answer that a clever compositor has mixed up 50° and 50 %."

Thus "Meteor" in our sudden flash of light caused by the discharge of electricity between two electrified regions of cloud, or between a cloud and the earth, contemporary. The expression in the *Electrical Engineer* is perfectly correct, as everybody knows who has had experience in telegraph work, experience from which "Meteor" can certainly claim exemption. We would strongly advise him to undergo a course of Preece and Sivewright, and *he* might also explain what *he* means by 50 %. 50 % of what?

The Edison Accumulator.—Our Niagara correspondent says that "Mr. Thomas A. Edison has directed that his new storage battery be withdrawn from any competition with other storage batteries at the Pan-American Exposition, and the cell that is now on exhibition there is at the Exposition with that distinct understanding. When this cell was sent to the Pan-American, it was not Mr. Edison's intention that it should be entered competitively with the other types of batteries, inasmuch as they were not in a position to show it working practically. Before the Exposition closes it is the Edison Company's intention to exhibit some of these new batteries complete and in actual operation, so as to show their superiority over anything of the kind on the market to-day. The battery cell that is now on exhibition is 5 in. wide, $1\frac{1}{2}$ in. deep, and 12 in. high from the base to the terminals. Its capacity is $\frac{1}{8}$-H.P., 100 ampere-hours, and its weight is $5\frac{3}{4}$ lbs. The cell is nickel plated, while the insulation is perforated hard rubber, $\frac{64}{1000}$-in. thick. It has eight plates or grids, each containing 24 pockets. The thickness of the complete plate is $\frac{1}{10}$ in. The charging rate is 1·8 volt. The pockets containing the compound are $\frac{3}{1000}$-in. thick, of nickel plated perforated crucible steel. The negative plate is nickel, and the positive plate iron. There is no alkaline solution in the cell on exhibition. This fluid is not an element of the battery—simply a conductor. In the regular construction of the batteries it is estimated that 60 plates constitute 1 H.P., each plate weighing 1 lb. The cell now on exhibition at the Pan-American Exhibition daily commands increased attention, showing that many are interested in this latest invention of Mr. Edison."

Disturbance of Ships' Compasses.—Rear-Admiral Bradford, chief of the Bureau of Equipment, says the *Electrical World*, has received an interesting letter from Lieutenant-Commander F. M. Bostwick, navigator of the *Oregon*, in which he describes the effect on the standard compass of a "ground" in the bridge electric circuit. While the *Oregon* was steaming up the China coast on course N. E. by N., the navigator reported that it suddenly became necessary to change the course about a point to the eastward by bridge and steering compasses, to make the allotted course by standard. Upon investigation it was found that the trouble lay with the standard compass. A time azimuth taken showed the deviation of the standard compass to be 10 and $\frac{4}{100}$ min. east, the tabulated deviation being 1° and $\frac{74}{100}$ min. Upon inquiry it was found that the bridge circuit had just been turned on, and later a "ground" was discovered. Experiments showed conclusively that the fault was due to this "ground." In order that this trouble may be avoided in the future, the secretary of the Navy has authorised the chief of the Bureau of Construction and Repair to inform the commandants of the Navy yards and the superintending naval constructors that hereafter the platforms for carrying the standard compass should, whenever practicable, be insulated from the structure of the ship by three-eighths of an inch of hard rubber fibre, and that the bolts securing platform stanchions to the structure should also be insulated by bushings and washers of the same material; also that all horizontal railings within 12 ft. of the compass should be made either of wood or Manila hemp rope.

Cost of a Lawsuit.—The cost of going to law is illustrated by the case tried at the Liverpool Assizes, in which certain company directors were sued for damages on account of a misleading prospectus. Mr. Asquith, K.C., was leading counsel for the plaintiff, and Sir Edward Clarke, K.C., for the defendants. According to the *Daily Mail*, the fee marked on each brief was 500 guineas. The trial lasted seven days, and the learned counsel each received 100 guineas a day as a "refresher"—altogether 1,200 guineas apiece. Correspondingly handsome fees were paid to the junior counsel engaged. The result of the trial was a verdict for the plaintiff, awarding £950 damages.

More Belleville.—According to the *Pall Mall Gazette* of Tuesday last, the flagship of the China Squadron is in trouble, six of her Belleville boilers being disabled. All the boiler-makers in the fleet are said to be on board endeavouring to stop leaks in her condensers and boilers, and it was estimated she would be helpless for three weeks.

Glasgow Exhibition Takings.—It is said that the whole expenses of the Exhibition were covered and the guarantee fund was safe within the first fortnight. Four or five days hence the total of admissions since the opening (5,476,377) will have beaten the record total of the exhibition of 1888 (5,745,929), and there are still $2\frac{1}{2}$ months to run. The average attendance per day is 54,500. Taking the present figures as a basis, a surplus of some £100,000 may confidently be expected at the close of the exhibition.

B. & W. Marine Boilers.—The recently completed trials of H.M.S. *Espiègle* (says the *Shipping World*) are especially interesting, as she is the first British warship to be fitted with Babcock & Wilcox boilers since these were experimentally tried in H.M.S. *Sheldrake*. The trials, which were carried through without a hitch, consisted of a 30 hours' run at about 330 I.H.P., 30 hours at 1,000 I.H.P., and eight hours' full power trial.

Appointment Vacant. — The Corporation of Doncaster wants a borough electrical engineer at £250 per annum.

NEW COMPANIES REGISTERED.

Union Electric Company, Limited (70,115).—This company was registered on August 13th, with a capital of £25,000 in £1 shares, to carry on the business of manufacturers, sellers and

suppliers of electric lamps, electric light contractors, electricians, electrical, mechanical, metallurgical, and general engineers, contractors for the supply of electrical or other force, agency or energy for the purposes of light, heat, power, traction or otherwise, metal founders, forgers and workers, smiths, &c. The first subscribers (each with one share) are:—H. Garbe, 19, Julicherstrasse, Aix-la-Chapelle, Germany, manufacturer of electrical apparatus; M. Muller, 19, Julicherstrasse, Aix-la-Chapelle, Germany, engineer; M. Körting, Leutzsch, near Leipzig, Germany, manufacturer of electric apparatus; H. J. Down, Harpenden, Herts, engineer; J. Eck, 5, Priory Road, Chiswick, W., electrical engineer; O. Barwinkel, 27, Woburn Place, Russell Square, London, W.C., gentleman; and G. W. Newall, 2 and 3, West Street, Finsbury Circus, E.C., solicitor. No initial public issue. The number of directors is not to be less than two nor more than five; the first are M. Muller, H. Garbe, and M. Körting; remuneration as fixed by the company.

Singapore Tramways, Limited (71,135).—This company was registered on August 15th, with a capital of £2,000 in £1 shares, to establish, maintain, and work by electrical, steam, horse, or other power rail and tramroads in the Straits Settlements, to carry on the business of generators, accumulators and distributors of electrical energy for the purposes of light, heat or power, and to construct, for the purposes of the company or otherwise, any machinery, plant, lamps, transformers, accumulators, dynamos, generators, motors, lines, wires and cables, &c. The first subscribers (each with one share) are:—F. Wood, 25, Selborne Road, Denmark Hill, S.E., clerk; H. J. Slinn, 6, Paget Road, West Dulwich, clerk; W. H. Autram, The Limes, St. Stephen's Road, Hounslow, clerk; J. D. G. Simpson, 7, Aden Grove, Green Lanes, Stoke Newington, clerk; F. J. C. Jeffrey, 50, Upper Street, N., clerk; J. M. Taylor, 124, Sebert Road, Forest Gate, E, clerk; and H. T. Adams, Ravenswood, Pinewood Road, Abbey Wood, Kent, secretary. No initial public issue. The number of directors is not to be less than three nor more than nine; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company.

Gearings, Limited (71,112).—This company was registered on August 13th, with a capital of £3,000 in 1s. shares, to adopt an agreement with F. W. Dunlop, to carry on the business of contractors, engineers, electricians, manufacturers of and dealers in cycles, motors, mechanically-propelled carriages, engines and all plant, materials and appliances relating thereto, or to be used in connection with the same, and to construct and maintain telegraph and telephone lines, electric and other lighting works, &c. The first subscribers (each with one share) are:—M. Crawford, 5, Warwick Court, Holborn; P. Stanley, 5, Warwick Court, Holborn, gentleman; T. L. Drimmie, 5, Warwick Court, Holborn, director; F. W. Dunlop, 5, Warwick Court, Holborn, engineer; Mrs. K. Dunlop, 5, Warwick Court, Holborn; Mrs. L. Drimmie, 5, Warwick Court, Holborn; and F. W. Drury, 5, Warwick Court, W.C., clerk. No initial public issue. The number of directors is not to be less than two nor more than seven; the first are P. Stanley, T. L. Drimmie and F. W. Dunlop; qualification, £10; registered office, 5, Warwick Court, Holborn, W.C.

Pneumatic, Electric and General Engineering Company, Limited (71,141).—This company was registered on August 16th, with a capital of £370,000 in £1 shares (220,000 preference), to adopt an agreement with Richard Payne, and to carry on the business of machine makers, tool makers, millwrights, mechanics, ironfounders, engineers, contractors, compressor manufacturers, metallurgists, refiners, manufacturers of pneumatic and electric tools and appliances, and pneumatic, electric and hydraulic railway and marine signal appliances, railway signal and interlocking apparatus makers and contractors, producers, storers and suppliers of heat, steam, compressed air and other power, coal, oil, gas and electricity, &c. The first subscribers (each with one preference share) are:—J. M. Lickfold, 4, Copthall Chambers, E.C., articled clerk; H. F. Crowley, Ferndale, 88, Park Road, Ilford, clerk; E. D. E. Jukes, 63, Redcliffe Road, South Kensington, S.W., solicitor; F. E. Jones, The Lawns, Sevenoaks, Kent, solicitor; A. S. Wicks, 7, Burnley Road, Stockwell, S.W., clerk; G. A. Vayre, 62, Minford Gardens, West Kensington, clerk; and J. A. Graydon, 1, Lyndhurst Square, Peckham, S.E., secretary. No initial public issue. The number of directors is not to be less than three nor more than 12; the subscribers are to appoint the first; qualification, £500; remuneration, 1 guinea each per board meeting attended.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical Power Distribution Company, Limited (57,907).—This company's annual return was filed on June 26th, when 14,980 "A" and 200 "C" shares were taken up out of a nominal capital of £300,000 in 14,980 "A" and 15,000 "B" shares of £10 each, and 200 "C" shares of £1 each. £8 has been called up on each of 12,980 "A," £10 on each of 2,000 "A," and £1 on each of 200 "C" shares, and £117,102 has been paid, leaving £7,128 in arrears. No mortgages or charges.

Blackheath and Greenwich District Electric Light Company, Limited (47,875).—This company's annual return was filed on May 6th, when 101,200 ordinary shares were taken up out of a nominal capital of £300,000 in 150,000 ordinary, and 150,000 preference shares of £1 each. £1 per share has been called up, and £101,200 has been received. Mortgages and charges, £100,000.

Mexico Electric Tramways, Limited (56,932).—This company's annual return was filed on June 28th, when 500,000 ordinary and 237,013 preference shares were taken up out of a nominal capital of £1,000,000 in £1 shares (500,000 preference); £1 has been called up and paid on each of the 237,013 preference shares and the 500,000 ordinary shares are considered as fully paid; mortgages and charges, £400,000.

Electrical Power Storage Company, Limited (39,313).—This company's annual return was filed on August 2nd, when 66 founders, and 18,592 ordinary shares were taken up out of a nominal capital of £100,500 in 100 founders' and 20,000 ordinary shares of £5 each; £5 has been called up on each founders' share and £4 on each of 3,132 ordinary shares, resulting in the receipt of £12,858, in addition to which £474 5s. 1d. has been paid on four founders' and 405 ordinary shares forfeited; £77,300 considered as paid on 15,460 ordinary shares; mortgages and charges, £28,400.

Lisbon Electric Tramways, Limited (62,983).—This company's annual return was filed on July 30th, when 500,000 ordinary and 165,007 preference shares were taken up out of a nominal capital of £1,000,000 in £1 shares (500,000 preference). All shares considered as fully paid. Mortgages and charges, £500,000. Subsequently to filing the above return, an additional allotment of 165,000 preference shares has been made.

Particulars of registered mortgages and charges: Date of trust deed, November 22nd, 1899. Total amount secured by series of debentures, £500,000. Date of resolution creating series of debentures, November 15th, 1899. Property charged, the undertaking of the company and all its property, present and future. Trustees, Ludwig Breitmeyer and Charles Rube, 120, Bishopsgate Within, E.C., merchants. Date of present issue, July 10th, 1901. Amount of present issue, £65,000, in 650 debentures of £100 each. Amount previously issued of same series, £435,000. Date of registration, July 30th, 1901.

CITY NOTES.

Baker Street and Waterloo Railway Company.

Mr. T. J. Harb (chairman) presided on 15th inst. at the Westminster Palace Hotel over the sixth half-yearly general meeting of the above company. In moving the adoption of the report, he said that the expenditure on capital account amounted to £276,851 during the half year. Of this, £146,208 had been spent in connection with the purchase of land, the principal item being the cost of the Indigent Blind School for the depôt and generating station. They regretted that the negotiations for the transfer of the contracts referred to at the last meeting, owing to totally unforeseen circumstances had not yet borne fruit. The position was, however, receiving the careful consideration of the directors, and negotiations were still proceeding, which it was hoped would be successful. In the meantime the sub-contractors were carrying on the works under a special arrangement with the company, and were now engaged in boring the second tunnel under compressed air in the gravel-bearing strata under the river. That was the most difficult operation they had, but the first tunnel was carried out without the slightest hitch, and so far the second tunnel had proceeded most satisfactorily. It being of the utmost importance that this work and other work should be carried to completion, the directors considered that the available cash assets of the company should be kept for that purpose. They did not, therefore, propose that any payment of interest should be kept accruing pending arrangements being made for raising the balance of capital. Looking at the small amount of capital available, it must be clear that it would be unwise to diminish it by the payment of interest. Since the last report the western tunnel between the river shaft and Waterloo had been extended to York Road, where it would join the large station tunnel at Waterloo. A length of 627 yards of that tunnel had been constructed, and the tunnel face was within the London and South-Western Railway property. The driving of the eastern tunnel between the river shaft and Waterloo was commenced on May 13th. It had now reached a point 120 yards south of the shaft, the face being in ballast, and air pressure having been used since June 24th. Northwards the gap existing in the eastern tunnel, between Charing

Cross and the Haymarket, had been filled up, and this tunnel was now complete together with its large station tunnels between the river shaft and a point in Regent Street, just north of Argyle Place. The western tunnel was stopped on May 4th at a point in Regent Street, 107 yds. north of Vigo Street. Beyond this point and Waterloo this tunnel was also complete with the exception of the enlargement required for the station tunnel at the Victoria Embankment. In accordance with the decision to confine the work to the part of the line south of Oxford Street, the tunnels being driven southwards from Baker Street station were stopped on May 4th. The western tunnel had then reached a point in Portland Place 154 yds. south of Park Crescent, and the eastern tunnel a point in Regent's Park, 80 yds. from the north side of Park Square. With regard to the station works, at Waterloo two lift shafts and the stair shaft had all been sunk to the full depth, and preparations were being made to construct the passages from the shafts to the tunnels. At the surface the lift chamber had been walled in and was ready to receive the iron flooring above it as soon as delivered by the makers. At Piccadilly the passages from the tunnels were complete as far as the shafts, but had not yet been continued round them, and at Oxford Street the adjoining property on the west side of the site had been underpinned, the remaining house was being pulled down, after which the sinking of the 18 ft. stair shaft would be proceeded with. Proceeding to refer to vibration, the Chairman quoted part of the report of the Vibration Committee, and pointed out that the Committee stated they believed that on new tubular railways under proper conditions no objectionable amount of vibration need be apprehended. He understood that the Central London Railway had now completed their experiments with a new locomotive, and the results were altogether satisfactory. No complaints as to vibration had been made either to the City and Waterloo or the South London Railway, and their engineers were of opinion that having regard to recent improvements in electric traction, there would be no difficulty with regard to vibration, and that their railway could, and would, be worked so as to avoid any objectionable vibration. The result of the working of the Central London Railway must be exceedingly satisfactory to everyone interested in the electric underground railways of London. Their working expenses, in spite of the high price of coal, were just over 54 per cent., and they had paid a dividend of 4 per cent. There was no doubt but that the improvements being continually made in electric traction would enable new electric railways to be worked at a considerably lower percentage. They had had in the case of the Central London Railway a striking illustration of the tramway connections at Shepherd's Bush, and the Baker Street Railway would pass St. George's Circus and end at the Elephant and Castle, which were the two largest tramway centres in London.

Sir Algernon West seconded the motion, and the report was adopted without discussion.

National Telephone Company.

Mr. J. S. Forbes presided on 15th inst. at the Cannon Street Hotel over the twenty-eighth ordinary general meeting of the above company, and in moving the adoption of the report, said the income of the half-year was £775,482, which was an increase of £74,879 compared with the corresponding period of 1900. Looking to the circumstances of the times, and what might have been a possible arrest of the progress of the business during the half-year owing to people waiting for the unknown, that seemed to them, at all events, satisfactory, seeing the disruption to trade and the serious commercial disturbances which had prevailed. The working expenses had increased, but not to such an extent as to leave them no increased profit. They were £457,363, as compared with £403,528 in the corresponding period of last year. The net result would appear to be arrived at by the deduction of £53,000, which was the amount of the increased expenditure, from £74,879, but that required to be modified by the fact that the Post Office royalties had to come out of it, and so the net result for the half year was an increase of £16,279. He would point out that they had to take the June half-year as a mere estimate, but it all worked out at the end of the year. Post Office royalties came to £73,229, an increase of £4,764, and in the expenditure they had £17,673 spent on repairing damages caused by the snowstorms in the early part of the year. The net result was a profit balance of £244,888, as compared with £228,609 for the corresponding period of 1900. They would notice that working expenses had crept up from 60·08 per cent. in 1899 to 62·52 per cent. last year, and this half-year they had reached 65·12 per cent. That would be alarming unless it was understood, but he would give some reasons why it had been swollen. They had somewhat altered the forms of their accounts, and had made up their mind to gradually write down quantities of stores. That half-year they had written off a considerable amount, and with the concurrence of the auditors they had brought in several fresh items for writing down on a more liberal scale in the future. That was a wise policy, if they did not trench too severely on the question of dividend. They were recommending the payment of a dividend of 5 per cent. on the ordinary shares and carrying a much larger sum to reserve. He supposed that a company like theirs, with a good deal of the unknown before them, were wise in building up their reserve fund. They proposed to place £65,000 to reserve and carry forward about the same sum as in the corresponding period.

Sir H. Fowler, M.P., seconded the motion.

Mr. Lea Smith said he would like to know something about the Government agreement.

The Chairman: You may draw me later on.

Mr. Kellitt said he agreed that the accounts were satisfactory were it not that they were subject to the guillotine in 10 years' time, but that being the case, he thought some policy should be put forward by the board which would prevent the waste of the shareholders' capital. It seemed to him a policy should be devised which would prevent the money of the ordinary shareholder being squandered. At present the policy was one of drift. He thought in case of no definite agreement with the Government that new subscribers for wires should be called upon to pay the cost of the installation. The capital cost of that was about £40, and if new subscribers were called upon to pay that sum they might be given ordinary shares in exchange, which should be saleable, and should bear the same rate of interest as the other ordinary shares, but which should carry no voting powers till about two years from the end of the company's leases.

The Chairman said the board would consider the matter, but it was a little complicated. They found it extremely difficult to induce the subscriber to pay his annual subscription in advance, and they had large outstandings, notwithstanding the fact that they were a ready-money company. If it was difficult to get £10, he thought it would be far more difficult to get £40.

The report was carried.

Mr. Lea Smith said, seeing that the stock had risen a point, it was only right that the chairman should make some statement as to the agreement with the Government.

The Chairman said it was public property that negotiations were going on between the Post Office and the company, but pending an agreement, he could say little. All he could say was that they trusted the negotiations would result in an agreement to work amicably with the Post Office. The shareholders could rely on the board doing the best to make an agreement which would benefit the company, and one which would enable them to work in amity with the Post Office, and would conduce to the public interest of London as regarded telephonic affairs.

A Shareholder asked if the shareholders could be called up to consider the terms of agreement?

The Chairman said that there they put him in a difficulty. He was afraid that if that was done they would arrive at the Greek Kalends, and not get a settlement. They had either to trust their directors or clear them out, and he thought they had men on that board as competent to conduct such negotiations as any board they could elect.

Another Shareholder said it would be only fair that the shareholders should know at the earliest possible moment whether an agreement was come to or not.

The Chairman said that directly an agreement was come to and sealed, the shareholders would be informed. He himself—and he only pledged himself—believed it would be satisfactory.

Schattner Electricity Meter Company.

The report of directors and statement of accounts from April 1st, 1900, to June 30th, 1901, submitted to the first ordinary general meeting of the above company, held at Dacre House, Victoria Street, Westminster, on Tuesday last, states that the company was incorporated on June 29th, 1900, but the business was taken over as a going concern as from April 1st, 1900. The amount to the credit of the profit and loss for the period for sales, &c., is £7,815 2s. 9d. The manufacturing costs amount to £4,336 18s. 4d., leaving a gross profit of £3,478 4s. 5d. From this has to be deducted expenses of administration and amounts written off for depreciation, amounting to £2,328 7s. 4d., leaving a balance of £1,149 17s. 1d. The board, acting on the advice of their auditors, have dealt with the profits made before the incorporation, viz, £216 1s. 10d., to write off preliminary expenses and part of the alteration to works, leaving the sum of £933 15s. 3d. now to be dealt with, which they propose should be as follows:—By payment of a dividend at the rate of 6 per cent. per annum on the subscribed capital, £486 12s. 7d.; to write off alteration to works, £100; and to carry forward £347 2s. 8d. The works at Norwich being inadequate for the business, the board decided to remove to London in March last, where a suitable factory was obtained. The business shows a steady rate of progress.

Mr. R. Stewart Bain took the chair on Tuesday at Dacre House, over the first ordinary general meeting of the company, and, in moving the adoption of the report, said the company was incorporated on June 29th, 1900, although the business was taken over as a going concern as from April 1st, 1900. The total sales of meters, after deducting the returns during this period, amounted to £6,453 13s. 5d., representing 1,613 meters, which, compared with the previous year, showed an increase of 304 meters. The output would probably have been considerably increased but for the removal of the works from Norwich. In consequence of the disadvantages attaching to the works being at Norwich they secured a factory in London, and the new works had been equipped with an additional number of new tools and machines, the introduction of which facilitated quicker production, and had already effected a satisfactory saving in the cost of manufacture. Other savings had been effected in the carriage of material, meters, and reduction in travelling expenses. They also got the advantage of a greater selection of labour, and as they were in the commercial centre of the kingdom were able to get visits from electrical engineers who would not have visited them in Norwich. The manufacturing charges of all descriptions amounted to

£3,236 10s. 11d., while the general charges amounted to £1,827 3s. 4d. The directors, who were entitled to £600 for their fees, in the first year had decided to only take half that amount. They had written off £190 5s. 6d. as depreciation on plant, &c., and provided for the only bad debt they knew of. This left a balance of £1,149 17s. 1d. to the credit of profit and loss account, but as £216 1s. 10d. were the profits made by the company before the incorporation, which could not be divided as profits, they had written off the whole of the preliminary expenses and part of the alteration to the new works to this amount, which left them with £933 15s. 3d. now to be dealt with, which was equal to about 11 per cent. on the subscribed capital from the dates it was called up. They recommended that a dividend of 6 per cent. be paid on such capital, that £100 be written off alteration to works, and that £347 2s. 8d. be carried forward. Proceeding to deal with the balance-sheet, the chairman pointed out that £17,800 was paid for the goodwill and patents, and they had transferred to separate accounts the value of the stock, machinery and furniture, thus reducing it to £16,217 9s. 3d., but they added £72 10s., which was the cost of obtaining new patents, so that the item now stood at £16,289 19s. 3d. The vendors were paid £5,300 in cash, and £12,500 in shares, which were deferred, as regarded dividend, until 10 per cent. had been paid on the £15,000 subscribed capital for one year. There was a further additional safeguard in connection with the subscribed capital, as after the payment of a dividend of 10 per cent. on the subscribed capital, the deferred shares would only be entitled to rank for dividend up to 6 per cent. after a non-cumulative preferential dividend of 6 per cent. shall have been paid in each year on the subscribed shares. Their meters were covered by letters patent in Canada, France, Belgium, and the United States, and negotiations for the sale of some of the patents were now in progress. They were, however, sending sufficient meters to those countries to more than cover any cost of upkeep. As regarded the future, he was able to speak very hopefully. The actual orders in hand amounted to about 400 meters, but in addition to that they had every reason to believe that they would obtain orders amounting to over 2,000 meters from other lighting authorities with whom they had been carrying on negotiations. Further, they were at present manufacturing a demand indicator, which would soon be ready for the market, and which they believed would be a source of considerable additional revenue to them, and a factor in reducing their establishment charges. Although that instrument was not yet in the market, orders of over 300 had already been promised. The board had been asked to take into consideration the manufacture of other instruments, and negotiations regarding these were now pending.

Mr. F. W. Harmer seconded the motion, and it was carried.

British Electric Transformer Manufacturing Company.

Mr. R. Stewart Bain (chairman) presided over the third ordinary general meeting of the shareholders of the above company, held on Wednesday at Dacre House, S.W., and in moving the adoption of the report, said he submitted that the payment of a regular dividend of 10 per cent., accompanied by an adequate but necessary amount to reserve, together with full provision for depreciation, and carrying forward a sum equal to a further dividend of 5 per cent. of undivided profits, was a position which they all had every reason to be satisfied with, and which he was pleased to say had been accomplished by careful and prudent management. During the year their output compared favourably with previous years. They had been very successful in securing contracts in competition, and the efficiency of their transformers made them exceedingly cheap. The satisfaction they gave was best demonstrated by the repeat orders they got. Their net sales had been £25,067 6s. 9d., as compared with £22,878 8s. 5d for the previous year. Their work in progress was £1,542 0s. 2d., as against £1,165 0s. 5d., and their other receipts £1,175 17s. 9d., as compared with £360 16s, the total being £27,785 4s. 8d., as compared with £24,404 4s. 10d., an increase of £3,381. On the debit side of the account their manufacturing charges had increased from £13,448 11s. 4d. last year to £16,682 12s. 11d. This increase had been entirely caused by the high price of materials, principally copper, but they were now taking this increase into consideration in their prices for transformers. Their total charges had been £21,126 15s. 2d., as compared with £18,219 16s. 1d. This left them with a profit on the year's working of £6,658 9s. 6d., as compared with £6,184 8s. 9d., being an increase of £474 0s. 9d., which they believed would have been considerably more but for the high prices of materials. Dealing with the figures in the balance-sheet, the chairman pointed out they had granted a license to the Union Electricitäts Gesellschaft, of Berlin, and a proportion of the sum received had been written off the value of the patents in the balance-sheet. During the year additional patents were obtained for three-phase transformers in the United Kingdom, Germany and America, and since the date of the balance-sheet these patents had also been covered in Austria, Belgium, France, Italy, Norway and Sweden, Russia and Switzerland. Their new works at Hays were rapidly approaching completion, which would give them a floor space of 17,000 sq. ft. By the end of the year the business would have been completely transferred. They had plenty of land for extension, and he was glad to say they hoped to complete and equip the new works without increasing their present capital. They were very busy, and overtime had to be worked almost continuously to keep pace with orders. As to the future, the prospects of alternating current business were very bright. Large power distribution schemes were getting their works laid out, and large transformer orders might be confidently expected. Their works had hitherto consisted chiefly of transformers for lighting purposes of comparatively small size with the exception of two large extra high tension supply companies' work, but for power distribution, in which to a large extent their future must lie, larger units would be the rule, and they believed that they stood in as good a position as any company in the kingdom to carry out efficiently and economically this class of work.

Mr. Petersen seconded the motion.

Replying to Mr. Vizard, the Chairman said the directors had taken the sum allotted to them by the auditors which was due to them under the provisions of the articles of association.

The report was adopted.

On the question of the re-election of a director, the Chairman said that Mr. Wallis Jones, the retiring director, had decided not to stand again, and therefore as the name of Mr. Billington was the only one before them, he would be elected a director.

Some discussion took place over the matter, and the Chairman said that the board desired to do everything they could for peace, and would work harmoniously with Mr. Billington.

Liverpool Overhead Railway Company.

The half-yearly general meeting was held on 13th inst. at Liverpool; Mr. G. H. Robertson presided, in the absence of the chairman of the company, Sir Wm. Forwood.

The Chairman, in moving the adoption of the report and financial statement, regretted that, in common with almost all the other railways, the dividend of the company showed a reduction as compared with the corresponding half of last year. This was chiefly caused by the increased price of coal and materials used by the company. The revenue account would probably be a little misleading, as the comparison was not on all fours with the first part of last year, in consequence of the opening of the tramway line to Waterloo and Crosby during the past 12 months. During the period mentioned there had been an increase of traffic on the two systems of £3,340, but, on the other hand, the expenditure was larger by £5,500. This was mainly due in the first place to the increased cost of coal, which during that period amounted to £1,313; also to tramway wages, £2,000; to rent of tramway lines and the taxes thereon, £900; to income-tax, £200; and to law charges, £220. There were also a number of smaller items of expenditure—which included a considerable amount for tramway stores, part of which they had in stock yet—amounting altogether to £867, making a total of £5,500. Some of the charges would be materially reduced this next half-year, because the price they were now paying for coal alone was 46 per cent. less than last year. The same thing applied to very many stores which had been used by the company in their business. There had been an increase of passengers carried by rail and tram of 694,362, the actual number of passengers carried by the tram alone being 908,936. The directors were very well satisfied with this increase, and they looked for even better results as regards this branch of the service in the near future. There was no doubt that the extension of the Liverpool Corporation system of electric trams to Seaforth (north end of the system) had, in some measure, interfered with the company's railway traffic. The traffic generally of the company during the past half-year compared unfavourably with the previous year, when there was a great deal of prosperity at the docks, and things were very brisk there on account of the transports. He was glad to say, however, that there had been an increase in their traffic to the Dingle (south end of the system), and he was in hopes they might, to a great extent, recover some of their lost passenger traffic to and from that point. A great many people who had deserted the company and gone to the Corporation trams had come back to them—presumably because it was better travelling on the railway, and because they, perhaps, met a better class of people. The railway had been singularly free from accidents, and 96 per cent. of their trains had run punctually. They carried 4,473,288 passengers, with a train mileage of 398,802, whilst the value of each passenger was practically 2d., or exactly 1 95d. The structure had been very carefully maintained, and the rolling stock was in excellent condition. The company was much indebted to their engineer and general manager (Mr. Cottrell) for his excellent work in connection with the tramway extension to Crosby, and the directors fully appreciated his energy as a manager and great skill as an electrical engineer. In concluding, he stated that Mr. James Barrow had retired from the board owing to ill-health, and his place had been taken by Mr. H. C. Woodward, who, as he travelled every day on the railway, would be of much assistance to the board.

Mr. John Brancher seconded the resolution.

A Shareholder inquired if anything had been done in the matter of forming a junction with the Lancashire and Yorkshire Railway Company at Seaforth.

The Chairman replied that the scheme had been before the directors for some time, but they had found it impossible to come to any terms that would be for the company's benefit in carrying it out at the present moment. Still, the matter would not be lost sight of. Replying to another question as to whether anything was being done to accelerate the train journey from end to end of the line from 35 to 25 minutes, thereby reducing the number of trains, the chairman said they had tried an experimental train which turned out very satisfactory, and it became merely a question of cost whether they should alter the whole service. It was highly probable that the matter would be brought before the shareholders at an early date.

The report and accounts were then unanimously adopted, and the dividends named above having been passed, the proceedings concluded with a vote of thanks to the chairman.

Official Announcements re Companies.

The *London Gazette* of the 16th inst. announces that the following companies, among others, have been struck off the register and dissolved:—

Davy Improved Arc Lamp Syndicate, Limited.
District Electric Supply Company, Limited.
Electrical Industries, Limited.
Electric Light Railways, Limited.
Electro-Metallurgical Company, Limited.
Folkstone District Electric Railways Company, Limited.
Rochester, Chatham, Gillingham, and District Electric Railways Company, Limited.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in Diesel Engine Company, Limited—37,575 cumulative preference of £1 each, 17s. 6d. paid, Nos. 1 to 37,575; and to allow the following to be quoted in the Official List:—British Electric Traction Company, Limited, further issue of 30,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 160,001 to 190,000.

W. T. Henley's Telegraph Works Company.—The directors have declared an interim dividend for the first six months of the current year at the rate of 4½ per cent. per annum upon the preference shares, and at the rate of 10 per cent. per annum on the ordinary shares, both payable on September 2nd, 1901.

Brush Electrical Engineering Company.—Notice is given that the transfer books of the first debenture stock of this company will, in view of interest payable on September 2nd, 1901, be closed from August 19th, 1901, to September 1901, both inclusive.

Charing Cross and Strand Electricity Supply Corporation.—Warrants for the dividend on the preference and ordinary shares have been posted to the shareholders.

TRAFFIC RECEIPTS.

Blackpool and Fleetwood Tramways.—The receipts for the week ending August 17th were £1,720; corresponding week last year, £1,973; decrease, £253. Total to date, £9,403; corresponding period last year, £9,760; decrease, £357.

Bristol Tramways and Carriage Company.—The receipts for the week ending August 16th were £3,646; corresponding period last year, £3,605; increase, £41.

Central London Railway.—The receipts for the week ending August 17th were £5,304; corresponding week last year, £4,580; increase, £724. Total receipts from July 1st (7 weeks), £41,206. Miles open, 6.

City and South London Railway.—The receipts for the week ending August 18th were £1,983; corresponding week last year, £1,534; increase, £329. Total to date, £12,911; corresponding period last year, £10,535; increase, £2,376. Miles open, 4½.

Dover Corporation Tramways.—The receipts for the week ending August 17th were £328 16s. 4d.; corresponding week last year, £354 1s. 4½d.; decrease, £25 5s. 0½d. Total to date, £6,985 12s. 3d.; corresponding period last year, £6,510 5s 3d.; increase, £425 7s. 0d. Miles of track open, 8. Car miles run, 1901, 5,388; 1900, 5,855. Number of cars, 1901, 12; 1900, 11.

Dublin United Tramways Company.—The receipts for the week ending August 16th were as follows:—D.U.T. Co., electric cars, £4,030 9s. 7d.; D.S.D. Co., electric cars, £1,068 9s. 3d.; total, £5,098 12s. 8d.; corresponding period last year—D.U.T. Co., electric cars, £4,820 9s. 0d.; ditto, horse cars, £ 3 8s. 7d.; D.S.D. Co., electric cars, £1,361 16s. 4d.; total, £5,715 13s. 11d.; decrease, £617 1s. 8d.; aggregate to date, £35,729 4s. 8d.; aggregate to date last year, £34,326 14s. 10d.; increase, £1,402 9s. 10d. The mileage worked is 45 miles electrically, as against 42 miles electrically, and two miles by horses, for the corresponding period last year.

Liverpool Overhead Railway.—The receipts for the week ending August 18th were £1,734; corresponding week last year, £1,818; decrease, £84. Total from July 1st to date, £12,306; corresponding period last year, £12,193; increase £113. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

After the better tone that came into evidence at the end of last week, the Stock Exchange feels sorely disappointed that the promise of a business revival has not yet been fulfilled. Although the money market remains easy, and accommodation is readily procurable at cheap rates, the stock and share markets are relapsing into their former listlessness. Instead of having exciting business, the Kaffir circus finds itself doomed to its own resources, the other mining sections indulge in horseplay, and the more respectable divisions merely sit with hand in pocket awaiting the business that has once more waxed so coy. Dealers in the telegraph market aver that they having nothing to do but play, and the spurt in Consols was too short-lived to afford any material assistance to purely investment securities.

Yet the electric supply market has nothing to grumble about. Its quiet strength is visibly asserted in our price lists this week, the marking of several shares "ex dividend" having failed to lower the quotations, which are, therefore, the amount of the dividend higher than they were a week ago. Nor is it an easy matter to deal at current prices in more than a few shares of the best varieties, and the market is obviously establishing itself in favour with the average investor. Now that the autumn and winter are advancing, when lighting companies expect to do well, the smaller capitalist will naturally turn to the electric supply list in the hope of finding shares that will pay him good interest and provide a likely means of securing better prices when he wants to sell. And certainly, than such shares as Westminsters, St. James's or Charing Cross it will be difficult to find more attractive investments of their class. The cheapening of coal must tell largely in their favour, and although the cost of the other material and of labour remains fairly high, it is the fuel bill that mounts up cruelly in the accounts of the supply companies.

But so long as such concerns as the British Electric Works Company and the Blackpool Electric Tramways (South), continue to drag the word electric into their titles, so long must distrust and discredit drag the market into ill repute. If it be nothing else, it is at least a very singular coincidence that South London Electrics should have been heavily sold within the last few days, and the price, which was fairly 3¼ a week ago, is now little better than 2½, at which a line of shares was put on the market. British Insulated Wire are about the same as they were last week, but, without any desire to be pessimistic, we should not be astonished to see a decline in them also.

In the railway department Central Londons are hard, and the Ordinary is now standing at par *ex* 2 per cent. dividend. The Deferred cannot be purchased under the same figure. Waterloo and City stock continues in demand, and the jobbers are putting up the price because they cannot buy the stock for which they have purchasing orders. Should the quotation advance another couple of points, say, to 95, proprietors need not hesitate to take advantage of the market, since the stock can scarcely be worth more intrinsically. There are plenty of better investments to be found that return a higher rate of interest, and, much as we should like to see some prospect of the line paying more than the guaranteed 3 per cent., we really know of none. At present there are buyers about at 94, and at that the investor receives a paltry £3 3s. 9d. per cent. on his money.

So far as the Stock Exchange is concerned, Marconi's Wireless Telegraphy might be a dead letter for all practical purposes. The shares keep at 2¼ without attempting to move, nor was the announcement that the *Kaiser Wilhelm der Grosse* had communicated with the Nantucket Lightship through the Marconi system enough to give any fillip to the shares. Those who were kept out of them by our suggestions when the quotation was up at 5, 6 and 7, must be congratulating themselves upon their astuteness. The company is now making a new issue of shares. Telegraph stocks maintain their values. Anglo-American Deferred has advanced to 10. We asked a well-known dealer in the market what he thought of them. "Oh, well," he replied, "of course the stock isn't worth 10 on its merits, and it's not likely to get any dividend next time, but there are a certain number of speculators who buy Anglo "A" at intervals, and they may put the price up." Western Telegraph shares are harder, and National Telephones are better at 4, although at the meeting the oracular chairman committed himself to no definite statement as to what negotiations are in progress between the Government and the company. The first Preference shares, were there a wider market, would begin to look attractive now. In the manufacturing list, Henley's are unchanged on the interim dividend at the rate of 10 per cent. per annum. Sir Hiram Maxim's electrical shares are $\frac{1}{16}$ premium; British Westinghouse Preference at 4¾ are also unaltered.

The resignation of the District chairman gives rise to a precisely similar feeling on the part of the stockholders. It is to be hoped that Mr. R. W. Perks, M.P., will make a better thing of the railway than Mr. Forbes has done, and if his success in connection with the splendidly-organised Wesleyan Million Fund be a criterion of his business capacities, the District proprietors have at least got a chairman with unusual talents. The Ordinary stock is a point better on the week at 30, and an interesting suggestion as to obtaining the electric supply from existing companies, which appeared in a letter to the *Times*, is well thought of by the market. Metropolitan Consolidated at 81 is dull.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1898.	1899.	1900.	Closing Quotations Aug. 14th.	Closing Quotation Aug. 21st.	* Business done during week ended Aug. 21st, 1901. Highest.	Lowest
96,900	African Direct Telegraph, 4 % Debs.	100	...	...	...	98 —101 xd	99 —102	101	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	78 — 83	78 — 83	...	...
822,700£	Anglo-American Telegraph	Stock	£3 9s.	73/6	3½%	52 — 55 xd	52 — 55 xd	...	...
3,088,540£	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	97 — 99 xd	97 — 99 xd	98½	97¼
3,088,540£	Do. do. Deferred	Stock	18s. %	£1 7s.	5s. %	9½ — 10	9⅝ — 10¼	10 5/16	9 15/16
44,000	Chili Telephone, Nos. 1 to 44,000	5	3 %	4 %	5 %	3⅜ — 4¼	3⅜ — 4¼	...	...
13,333,300$	Commercial Cable	$100	8 %	8 %	...	175 —185 xd	175 —185	...	...
1,589,496£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	101 —103	101 —103	102¼	...
16,000	Cuba Telegraph	10	8 %	7 %	...	6 — 7	5 — 6	5	...
6,000	Do. 10 % Pref.	10	10 %	...	...	14½ — 15½	14½ — 15½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	3 — 4	3 — 4	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	9 — 10	9 — 10	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	99 — 103⅜xd	99 —103⅜ xd	...	...
60,710£	Direct United States Cable	20	3½%	3½%	3½%	10½ — 11½	10½ — 11½	11	10⅞
104,300£	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	99 —102 xd	99 —102 xd	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	142 —147	143 —148	146	143
1,826,888	Do. 3½ % Pref. Stock	100	...	...	...	94 — 97	95 — 98	94⅞	94⅛
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	112 —116	113 —116	115	113⅝
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	13⅜ — 14¼	13⅜ — 14¼	14⅛	...
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	110 —115	113 —118	...	...
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	...	5¼ %	...	99 —102	99 —102	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—3,000	25	...	...	...	100 —103⅜	101 —104	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	5¼%	10½ — 10⅝	10½ — 10⅝xd	10⅝	10½
180,042	Do. do. 6 % Pref.	10	6 %	...	...	14⅜ — 15¼xd	14⅜ — 15¼xd	15	14⅛
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	...	15 %	31 — 33	31 — 33	...	...
78,000£	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102 xd	100 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	41 — 45	41 — 45	44	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	...	...	...	103 —106	104 —107	104½	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	...	2½%	...	¼ — ½	¼ — ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	4 %	5 %	...	½ — 1	½ — 1	...	...
590,000	National Telephone, 1 to 590,000	5	6 %	5 %	5 %	3⅜ — 4	3⅞ — 4⅛	4⅛	3⅞
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	12	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅛ — 4⅜	4⅜ — 5	5	4 9/16
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	89 — 92	92 — 95	92¾	...
500,000£	Do. 4 % Deb. Stock Red.	100	...	...	4 %	94 — 97	95 — 98	97⅜	96¼
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	6 %	⅞ — 1	⅞ — 1	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	99 —102 xd	100 —103	...	...
11,839	Reuter's	8	5 %	5 %	5 %	7 — 8	7 — 8	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	125 —130	126 —131	...	...
58,000	United River Plate Telephone	5	6 %	7 %	...	5 — 5¼	5 — 5¼xd	...	...
40,000	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4⅜ — 5¼xd	4⅜ — 5¼ xd	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	101 —104	102 —105	...	...
171,000	West African Telegraph, 5 % Debs....	100	...	...	...	100 —103	101 —104	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼ — ⅜	¼ — ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	99 —102	100 —103	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	13⅜ — 14¼	13⅜ —14¼ xd	14¼	...
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	101 —104 xd	101 —104 xd	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	100 —103 xd	101 —104	103	...
88,321	West India and Panama Telegraph	10	2 %	⅝%	...	¼ — ½	¼ — ⅜	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	4½ — 5½	5 — 6	5	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3 — 5	3 — 5	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	101 —104 xd	101 —104 xd	...	...

ELECTRICITY SUPPLY COMPANIES.

19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	6 %	7⅜ — 8¼	7½ — 8 xd	7 15/16	...
12,000	Do. do. 7 % Cum. Pref....	5	...	...	...	8½ — 9	8½ — 8⅝xd	...	...
50,000	Charing Cross and Strand Electricity Supply	5	8 %	9 %	9 %	9 — 10	9 — 10 xd	9⅜	9⅛
20,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5½ — 5⅝	5½ — 5⅝xd	5½	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	6 %	5½%	5½ — 6	5½ — 6	...	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	107 —110 xd	107 —110	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	6 %	4 %	0 %	8 — 9	8 — 9	8⅜	8⅛
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	12 — 13 xd	11½ — 12½	12 1/16	11⅝
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	120 —125 xd	120 —125 xd	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	*nil*	4 %	4 %	8½ — 9½	8 — 9 xd	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	12 — 13	12 — 13 xd	12	...
200,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	103 —106 xd	103 —106 xd	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	6 %	7 %	5½ — 6 xd	5⅝ — 6¼	...	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	5¾ — 6 xd	5¾ — 6	...	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	102 —105 xd	104 —107	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	...	...	...	11 — 12 xd	11 — 12	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104 xd	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1½ — 1⅝	1½ — 1⅝	...	...
49,840	Do. do. do. do. 6 % Pref.	5	6 %	...	...	4 — 5	4 — 5	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	96 —100	96 —100	...	...
85,000	Metropolitan Electric Supply, 101 to 62,500	10	5 %	5 %	6 %	13 — 14	13 — 14 xd	13½	...
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	108 —111 xd	109 —112	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	94 — 97 xd	94 — 97 xd	...	...
6,452	Notting Hill Electric Lighting	10	6 %	7 %	7 %	15 — 16 xd	15 — 16	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½ — 15½xd	14½ — 15½xd	15 1/16	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½ — 9½xd	8½ — 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	97 —100 xd	97 —100 xd	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90 xd	80 — 90 xd	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½ — 3½	2 — 3	2⅞	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000... ...	5	12 %	13 %	10½%	11½ — 12½	12 — 13 xd	12⅝	12⅛

* Subject to Founders Shares. Quotations on Liverpool Stock Exchange.
Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked † are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years.			Closing Quotation Aug. 14th.	Closing Quotation Aug. 21st.	Business done week ended Aug. 21st, 1901.	
		‡	1898.	1899.	1900.			Highest	Lowest.
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	7 — 8	7 — 8	...	...
300,000*l*	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	89 — 93	89 — 93	92	...
45,000	British Electric Traction	10	6 %	8 %	9 %	13¾ — 14¼	13¾ — 14¼	14¼	13 13/16
50,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12 — 12½	11¾ — 12¼xd	12¼	...
350,000*l*	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	122 —125	122 —125	124¼	...
70,000	British Insulated Wire Ord.	5	15 %	20 %	15 %	9⅛ - 10⅛	9⅛ — 10⅛	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	6 — 6½	6 — 6½xd	5⅞	...
50,000	¶Browett, Lindley & Co. (1893), Ord.	£1	...	...	8 %	⅞ — 1	...	...	...
50,000	¶ " " " 6 % Cum. Pref.	£1	...	...	6 %	1 1/16 — 1 1/16	...	...	...
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	2	5 %	6 %	...	1⅛ — 1⅛	1⅛ — 1⅛	...	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000 ...	2	6 %	6 %	...	2⅛ — 2⅜	2 — 2¼	2⅛	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	103 —108	103 —108	...	...
108,710*l*	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	99 —102 xd	99 —102	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	15 %	14½ — 15½	14½ — 15½	...	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5⅜ — 6¼	5⅜ — 6¼	...	...
90,000*l*	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	107 —111	108 —112	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	...	101 — 104	99 — 102	102	100
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	...	101 — 106	103 — 106	105	102
440,100	Do. do. Def. do.	Stock	...	...	...	97 — 100	98 — 101	99	98½
855,000	City and South London Railway	Stock	2⅛%	1⅞%	1¼%	52 — 54 xd	52 — 54 xd	54	52½
37,500	Do. do. Ord. shares Nos. 22,501 to 60,000	10	...	...	...	5½ — 5⅝	5½ — 5⅝	...	...
54,000	Crompton & Co., Nos. 1 to 54,000	3	6 %	7½%	8 %	3½ — 4	3½ — 3⅝xd	3½	...
100,000*l*	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	100 —105 xd	100 —105	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	6 %	2½%	0 — ½	0 — ¼	⅜	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	6 %	2½%	1½ — 2½	1½ — 2½	...	...
344,023*l*	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	80 — 85 xd	80 — 85	...	...
100,000*l*	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	85 — 90	85 — 90	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	1½ — 2	1½ — 2	...	...
25,000	Do. do. 7 % Cum. Pref., 1 to 25,000... ...	2	7 %	...	...	2¼ — 2⅜	2¼ — 2⅜	...	...
182,500*l*	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	98 —102 xd	98 —102 xd	100	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9⅜ — 10¼	9⅜ — 10¼	...	...
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	99 —102	99 — 102	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	14 %	15 %	20 %	16 — 17	16 — 17	16⅜	...
35,000	Do. do. do. 4½ % Pref.	5	...	4½%	4½%	5½ — 6	5½ — 6	...	...
50,000*l*	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	109 —113	110 —114	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	21⅛	...
300,000*l*	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	101 —104	101 —104	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3½%	3½%	3½%	7 1/16 — 7 1/8	7⅛ — 7⅜	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5	...	13 — 13¼	13¼ — 13½	...	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	...	6 %	... — ...	19/- to 20/-	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	37 — 41	38 — 42	41	39½
150,000*l*	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	... %	...	102 —105	104 —106	105½	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 20,000	5	8 %	12 %	12 %	10½ — 11½	10½ — 11½	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½ — 6	5⅝ — 6¼	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	91 — 94	92 — 95	94	92½

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1⅛—⅞
National Electric Free Wiring, 12/6 paid, ¼—⅛.
* From Birmingham Share List.
¶ From Manchester Share List.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 15½—16½.
Do. do. Pref. (£10 pd.), 10—11.
*T. Parker, £10 (fully paid), 16½.

Bank rate of discount 3½ per cent. (June 6th, 1901).

MARKET QUOTATIONS, Wednesday, August 21st.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a " Nitric	per cwt.	22/-	22/-	..
a " Oxalic	per cwt.	82/-	82/-	..
a " Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	99/-	99/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a " ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£15	£15	..
a Benzole (90 %)	per gal.	7/-	7/-	..
a " (50/90%)	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£23	£23	..
a Lead, Nitrate	per ton	£24	£24	..
a " White Sugar	per ton	£31	£31	..
a " Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	3½d.	3½d.	..
a " Caustic (75/80%) ..	per ton	£24	£24	..
a " Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	61/-	61/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6	£6	..
a " Recovered	per ton	£5 10	£5 10	..
a " Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a " Crystals	per ton	£3	£3	..
Bichromate, casks ..	per lb.	2¾d.	2¾d.	..

METALS, &c.				
b Aluminium Wire, in ton lots..	per ton	£224	£224	..
b " Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots..	per ton	£75 to £140	£75 to £140	..
c Brass (rolled metal 2" to 12") basis	per lb.	7½d.	7½d.	..
c Tube (brazed)	per lb.	10d.	10d.	..
c " " (solid drawn) ..	per lb.	9½d.	8½d.	..
c " Wire, basis	per lb.	8d.	8d.	..
c Copper Tubes (brazed) ..	per lb.	11d.	11d.	..
" " (solid drawn) ..	per lb.	10½d.	10½d.	..
g Copper Bars (best selected) ..	per ton	£82	£83	£1 dec.

METALS, &c. *(continued.)*				
g Copper Sheet	per ton	£85	£85	..
g " Rod	per ton	£85	£85	..
e " (Electrolytic) Bars ..	per ton	£82	£82	..
e " " Sheets ..	per ton	£90	£90	..
e " " Rod ..	per ton	£84	£84	..
e " " H.C. Wire	per lb.	9¾d.	9¾d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f " Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	3/9 to 3/10	3/6½ to 3/8	inc.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i " Pig (Cleveland warrants) ..	per ton	46/3	45/10	5d. inc.
i " Forgings, according to size	per ton	From £11	From £11	..
i " Scrap, heavy	per ton	50/- to 52/6	50/- to 52/6	..
i " Wire, galvanised No. 8 ..	per ton	£10	£10	..
g Lead, English Ingot	per ton	£12	£12 to £12 2 6	dec.
g " " Sheet	per ton	£13 5	£13 5	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£9	£9	..
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d " " " medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d " " " large ..	per lb.	3/8 to 7/8	3/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	1/0½ to 1/8	1/0½ to 1/8	..
p " rolled bars & rods	per lb.	1/1 to 1/4	1/1 to 1/4	..
p " " strip & sheet	per lb.	From 1/8	From 1/8	..
o Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	10½d. to 1/0½	10½d. to 1/0½	..
i Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15 to £40		..
i " " in bars		£58	£58	..
g Tin, block	per ton	£118 10 to £119 10	£118 to £119	10s. inc.
g " foil	per lb.	1/6	1/6	..
n " wire, Nos. 1 to 16	per lb.	1/9	1/9	..
p White Anti-friction Metals — "White Ant" brand	per ton	£35 to £65	£35 to £65	..
j Yarns, Cotton, Single 10 lb. b'ndl's	per lb.	8¼d.	8¼d.	..
j " Best Flax, 6 lea.	per lb.	6d.	6d.	..
j " Hemp, 3 ply 10 lbs. ..	per lb.	4¾d.	4¾d.	..
j " " Russian, 10 lbs. ..	per lb.	5½d.	5½d.	..
j " Jute, 160 lbs. rove ..	per ton	£14	£14	..
k Zinc, Sh's. (Vielle Montagne bnd.)	per ton	£22 10	£22 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

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THE NEW GERMAN TARIFF ON ELECTRICAL MANUFACTURES.

We give below an abstract of the new German tariff in so far as it relates to the electrical industry. The tariff, which is proposed to form the basis of the new commercial treaties to be entered into before the expiration of existing agreements at the end of 1903, is founded upon the net weight of the goods, and the amount of the duty standing opposite each article is given in marks per double centner (2 cwt.). The most remarkable points in connection with the tariff are the large increases proposed on steam engines, turbines and glow lamps.

	New tariff in marks.	Present tariff in marks.
Net weight of article.		
Dynamos, motors, transformers, armatures, commutators and coils—		
5 double centners or under	9	—
5 to 30 double centners	7	2½ to 8
Exceeding 30 double centners ...	6	—
Note.—Machinery in rigid connection with a dynamo or motor is subject to duties, of which the following are examples:—		
Net weight of machine.		
Portable engine of 6 tons or under ...	9	8
Steam engines, turbines, pumps, &c.—		
40 kilogrammes or under	100	—
40 kilos to 1 double centner	60	—
1 double centner to 2 double centners	38	2½ to 8
2 „ centners to 5 „ „	25	—
5 „ „ 10 „ „	18	—
10 „ „ 25 „ „	13	—
25 „ „ 50 „ „	10	—
50 „ „ 500 „ „	7	—
500 „ „ 1,000 „ „	5½	—
Exceeding 1,000 double centners ...	3½	—
Secondary batteries and electrodes:—		
Without celluloid or hard india-rubber combination	6	—
In combination with celluloid or hard rubber	24	—
Insulated cables for laying in the ground or in water	8	8
Arc lamps	40	—
Searchlights and reflectors	20	—
Electric glow lamps	120	24
Telegraph apparatus, telephones, electrical devices for lighting, transmission of power or electrolysis, as well as for medical and dental purposes, measuring, enumerating and registering instruments, switch and shunt resistances, galvanic and dry cells, and thermal elements; other electrical apparatus and parts of electrical apparatus ...	60	Various.
Raw copper	Free.	
Copper wire	12	8

Note.—The kind or quality of the materials used has no influence in determining the duty on electro-technical productions.

FIREMEN AND ELECTRIC SHOCKS.*

By GUIDO SEMENZA.

During recent years cases have been reported of firemen receiving shocks from electric lighting conductors while engaged in extinguishing a fire. Such shocks have been attributed to the conductivity of the stream of water from the hose coming into contact with the wires, and as a result firemen have come to view electric conductors as a source of real danger from this cause. To those who are aware of the small conductivity of pure water, a shock from the cause attributed does not seem very probable, for the reason that a column of water of the size which comes from a nozzle must have a notably high resistance. It might, however, be asserted that some phenomenon due to electric capacity may account for the shocks which have been received, and in order to determine this question the writer performed some experiments with the aid of the Milan Edison Company, which kindly offered the use of its laboratory for this purpose.

In this laboratory there are available direct current at voltages varying from 2 to 550, and alternating current at 42 cycles and 4 voltages varying from 10 to 3,000 volts; besides, a connection can be made with an electric railway circuit and with a three-phase, 3,600-volt network. The trials were made of two kinds—with direct current and with alternating current. The experiments took place in a large yard quite close to the laboratory, in which a plate of metal about a yard square was placed in slightly inclined position on porcelain multiple petticoat insulators. This sheet was connected to one of the conductors, the other of which was well earthed. The experiment was performed in the following manner:—

A fireman, with his boots and bottom part of his trousers wetted, placed himself near the spot where the wire was grounded, and directed a jet of water from a nozzle against the metal plate, holding with bare hands the metallic nozzle. The water was supplied by a steam pump at a pressure which could be made as high as 180 lbs. to the sq. in. The voltage was measured in the laboratory with the necessary instruments, and at intervals the voltage between the metal plate and the earth was determined so as to be sure that a good earth connection was being maintained.

Before passing to a description of the experiments it should be said that though the results of the trial have a great practical value from giving a sure measure of the dangers to which firemen may be subjected, on the other hand, they cannot be considered exact from the scientific point of view for the reason that one of the testing instruments was necessarily human organism. As is well known, a large difference as to sensibility exists between different persons with respect to electric shocks. It was found, for example, that the length of water jet at which different firemen began to feel the current varied as much as 50 per cent., and the length of jet at which shocks could be supported varied considerably with different men. Besides, it was found that the sensibility of the same person varied within certain limits from day to day, and that those accustomed to receive shocks have a lesser sensibility to them. As the results obtained were thus affected by the human element, the experiments consequently cannot be claimed to be of a scientific order, though sufficiently decisive for practical purposes.

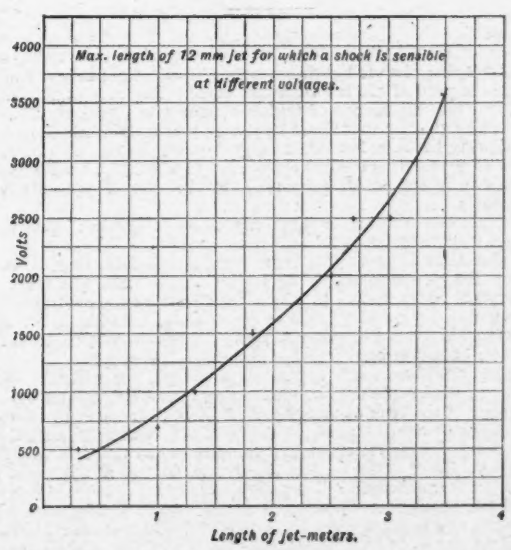
Direct current was supplied from a storage battery of 250 cells, and the voltage varied by connecting up the cells in different ways. Sensations were not felt up to 200 volts. At 200 volts a slight pricking in the hands was experienced when the pipe was approached to within about an inch of the metallic plate; indeed, in order to render the sensation surely perceptible, the nozzle had to be moved so that the jet touched the plate intermittently. A shock was then felt owing to the resulting opening and closing of the circuit.

Upon raising the voltage gradually to 500 volts, the distance at which one began to feel slight shocks rose to 2½ to 3 in. Nozzles of various diameters were then tried, and with a jet from a nozzle 2 in. in diameter shocks began to be perceptible with a length of jet slightly over 3 ft.

As these experiments partook of a laboratory character, to remove any doubt that could arise as to the influence of the self-inductance of the machines or the capacity of the lines, the experiment was repeated by directing the water jet on a trolley wire in service. The fireman climbed a wooden structure, with one hand grasped a wire having a good connection to the track rail, and with the other hand held a nozzle which directed a jet on the trolley wire. The results were identical with those obtained in the laboratory.

During the experiments with alternating currents, the current was obtained from a transformer with a ratio varying from 1-1 to 1-4, the upper limit of the voltage being 400. Above 400 volts an alternator was used. Experiments could thus be made at any voltages from 40 up to 3,600, the frequency in every case being 42. Trials were made with nozzles of different diameter and with jets under different pressures.

With a jet from a ½-in. nozzle under such a pressure that the column of water reached its destination without breaking, the first sensation was at 40 volts with the nozzle at about 1 in. from the plate. With the increase of voltage the distance gradually increased, and at 500 volts it was about 7½ in. The shocks from alternating current are therefore perceptible sooner than with direct current, as was to be foreseen; and the sensation is also different, the direct current giving an instantaneous shock upon opening and closing the circuit, while the shock from alternating current is continuous and gives a sensation of strong pricking.



Curve Showing Relation of Water Jets and Voltage.

* *Electrical World and Engineer.*

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The accompanying diagram shows the curve relating to the length of the water jet at which the shock becomes perceptible with the voltage, and referring to a ½-in. nozzle. Though the curve, for reasons above pointed out, is lacking in mathematical precision, still it gives a sufficiently clear idea of the case, and from it can be noted that the effect is smaller for a given percentage increase of length of water jet than it is for the similar increase of the voltage.

The maximum value of the voltage used was 3,600 volts, and at this tension a sensation was perceptible at a distance of about 10 ft. A person of average sensibility can endure the sensation from this voltage without great inconvenience up to a length of jet of about 3 ft. The section of the jet, however, notably changes these distances. Thus, with a 2-in. jet the shock is perceptible for 500 volts at 8 ft., and with 3,600 volts it is quite strong at 24 ft.; at 13 ft. it becomes quite intense, and nearly reaches the limit at which it may be supported by a person of average sensibility. The form of jet has a great influence, which can be easily understood. A continuous jet must offer very much smaller resistance to the current than one which breaks or scatters. This was quite clearly shown by experiments. With equal lengths of water jet the sensation is stronger the smaller the velocity, as with the smaller velocity the stream is much more compact. This explains why the shock increased less rapidly than the voltage; in fact, the greater the distance the less easy it is to maintain a compact jet.

After having finished the experiments in the manner above described, tests were made to see if the effects of the capacity of a system of high-tension cables, transformers and motors, such as may form part of a city distribution, might introduce any changes. For this purpose one of the conductors of the three-phase distribution of Milan was put into communication at 3,600 volts with a metal plate and a water jet directed against the latter. The difference of potential with respect to the earth was about 2,000 volts. No notable divergence was observed from the experiments that had been made with 2,000 volts in the laboratory.

The conclusions of a practical order that may be drawn from these trials are quite important. Above all, they showed that it is practically impossible for a fireman to receive a shock from a wire at a low potential without approaching a nozzle to within about an inch of the conductor, and only in this case when the fireman holds the nozzle with one hand and an earthed conductor with the other, and is well soaked with water. As a consequence, firemen can be assured that they may throw water on live conductors without danger of shock. The shocks felt by firemen in throwing water on electric light wires of 220 volts cannot be explained except by admitting a direct contact between the pipe and the wires. The results of these experiments are consequently reassuring with respect to the supposed dangers to firemen from electric conductors, such as may be encountered in extinguishing fires.

THE SMOKE NUISANCE IN ITS LEGAL ASPECT.

(From our Legal Correspondent.)

The articles which have recently been published in these columns in connection with the smoke nuisance serve to show that, under the present *régime*, electric lighting companies are not unlikely to come within the peril of the law from this cause. The risk of prosecution, and the importance of taking measures to avoid it, is not lessened by the fact that in recent years a Smoke Nuisance Prevention Society has been formed, the object of which is to provide the means of prosecuting opulent companies, to whom the burden of a small fine is out of all proportion to the cost of preventative alterations.

In these circumstances a short exposition of the law upon the subject may be found useful.

A perusal of the Acts which have been passed from time to time during the present century discloses the fact that, while many attempts have been made to control the issue of smoke from the factory chimney, nothing has been done to interfere with the private individual in his consumption of fuel. In other words, the kitchen chimney has never been regarded as a public nuisance.

Before the State made any attempt to interfere with the discharge of smoke into the air, the common law of England provided a remedy in the form of an indictment, if the smoke assumed the magnitude of a public nuisance, whilst if the comfort of his existence was being interfered with, it conferred upon the private individual a right of action against the wrongdoer. And this right is so jealously guarded, that if a person come to a place in the neighbourhood of which a nuisance is actually in existence, such, for instance, as a noisome chemical works, or a smoky chimney, he can equally enforce his legal remedies in respect of that nuisance as if he had been there first and the nuisance had subsequently commenced. (Sturges *v.* Bridgman, 11 Ch. D., 852.)

The test which has to be applied in arriving at a definition of the term "nuisance" was formulated long since by Lord Justice Knight Bruce in Walter *v.* Selfe. (4 De G. and Sm., 322). He there said, "The question is, Ought this inconvenience to be considered in fact as more than fanciful, more than one of mere delicacy and fastidiousness, as an inconvenience materially interfering with ordinary comfort, physically, of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain and sober and simple notions amongst the English people?"

In Crump *v.* Lambert (L.R. 3 Eg. 403) the plaintiff purchased two leasehold houses at Walsall. After he had taken possession the defendants commenced to erect, and ultimately completed, works in the neighbourhood of these houses. From these works, which contained two blast furnaces, the smoke and effluvia were carried away by means of a chimney 50 ft. high. The plaintiff filed a bill to restrain the defendants from creating smoke and effluvia, and from allowing noises to be made anywhere near the plaintiff's houses. In giving judgment for the plaintiff, Lord Romilly, M.R., said:—"With respect to the question of law, I consider it to be established by numerous decisions that smoke, unaccompanied with noise or noxious vapour, that noise alone, that offensive vapours alone, although not injurious to health, may severally constitute a nuisance to the owner of adjoining or neighbouring property; that, if they do so, substantial damages may be recovered at law, and that this Court, if applied to, will restrain the continuance of the nuisance by injunction in all cases where substantial damages could be recovered at law." With regard to the mode of procedure, the action should be brought against the occupier and not merely against the owner of the premises upon which the nuisance is created. Thus, in the case of Rich *v.* Basterfield (1847, 4 C.B., 782), an action was brought against the defendant, the owner of the premises, for a nuisance arising from smoke issuing out of a chimney, to the prejudice of the plaintiff in his occupation of an adjoining tenement, on the ground that the defendant, having erected the chimney and let the premises with the chimney so erected, had impliedly authorised the lighting of a fire. It was decided that no action lay against him.

It has been mentioned that a public nuisance forms the subject matter of an indictment and a criminal prosecution. In thus setting the law in motion, a private individual, although acting *pro bono publico*, used to find himself burdened with heavy expenses. With a view to encouraging the public to embark upon such prosecutions, an Act was passed in 1821 by which it was provided that "Whereas a great degree of injury was sustained by his Majesty's subjects from the improper construction as well as from the negligent use of furnaces employed in the working of engines by steam, and that, although such nuisances, being of a public nature, were abatable by indictment, the expense of the indictment had deterred persons from prosecution, the costs of such indictments might thereafter be awarded by the Court to the prosecutor or prosecutors." This may be regarded as the first important attempt on the part of the Government to bring the owners of factories, &c., who made use of steam-power, within the pale of a more expeditious and effective control.

The question of smoke nuisance was next dealt with in the Railway Clauses Consolidation Act of 1845, with the provisions of which we are not at present concerned, as they only relate to locomotives.

The Towns Improvement Clauses Act, which was passed in 1847, next demands attention. This was only applicable to such towns and districts as might thereafter be comprised in any Act of Parliament, with which it was specially incorporated. It was, therefore, but limited in operation. By Sec. 108 it was provided (in effect) that every fireplace or furnace constructed after the passing of any special Act for the regulation of any town or populous district, in order to be used for engines by steam, in factories, mills, &c., shall be so constructed as to consume the smoke arising from the combustibles used in the fireplace or furnace, and every fireplace or furnace at that time existing which is not so constructed shall be so altered as to consume such smoke. It also provides that if at any time any person should have a fireplace or furnace not so constructed, or so negligently use any such fireplace or furnace as not to consume the smoke arising from the combustibles used therein, he should be liable to a daily penalty of 40s. for every day during any part of which such furnace or fireplace should be so used and continued after one month's notice in writing should have been given to the owner or occupier of such furnace or fireplace by the Commissioners to remedy or discontinue the use of the same. The words "as far as possible," which occur in the Act, have been the subject of judicial opinion. In Cooper *v.* Woolley (L.R. 2 Ex., 88) it was decided that they must be taken to mean as far as possible consistently with carrying on the trade in which the furnace was employed. It is upon this Act that local bye-laws are founded.

The next two Acts were "An Act to Abate the Nuisance Arising from the Smoke of Furnaces in the Metropolis and from Steam Vessels above London Bridge," which was passed in 1853, and the Nuisances Removal Act of 1855. These have both been repealed by the Public Health (London) Act of 1891, the terms of which, so far as they relate to smoke nuisance, will be considered hereafter. It may be observed in passing that the provisions of both these Acts applied to London only. The first enactment which extended to the whole of England, with the exception of London, was the Public Health Act of 1875. Sec. 91 is devoted to the suppression of nuisances, and Sub-sec. 7 to those which are occasioned by smoke. As this is similar to Sec. 24 of the Public Health (London) Act, 1891, it will be dealt with further on.

Questions relating to smoke nuisance, so far as the metropolis is concerned, are now dealt with in Secs. 23 and 24 of the Public Health (London) Act, 1891. By Sec. 23, Sub-sec. (1), every furnace employed in the working of engines by steam, and every furnace employed in any public bath, &c. (enumerating a number of factories and similar institutions) . . . . shall be constructed so as to consume or burn the smoke arising from such furnace; and by Sub-sec. (2) any person being the owner or occupier of the premises, or being a foreman or other person employed by such owner or occupier (*a*) using any furnace not so constructed, or (*b*) so negli-

gently using any such furnace that the smoke arising therefrom is not consumed, becomes liable to the penalties therein mentioned.

For the purpose of supporting a charge against an owner or occupier of trade premises within the Metropolis of negligently using a furnace, so that the smoke is not effectually consumed contrary to 16 and 17 Vict., c. 128, Sec. 1, the language of which is similar to that of the above section, evidence must have been given of negligence on his part, the negligence of a servant being insufficient.

In Chisholm *v.* Doulton (1889, 22 Q.B.D., 736), the owner of premises in the Metropolis was summoned under the Smoke Nuisance (Metropolis) Act of 1853, the language of which is similar to that of Sec. 23. It appeared that smoke issued for the space of 10 minutes on the morning of the day in question from one of the defendant's furnaces, but it was found that the furnaces were properly constructed, and that there was no negligence on the part of the defendant or his foreman. The smoke was caused by the act of the stoker who lighted the fire. In deciding that the defendant could not be held criminally responsible for the negligence of his servant, Field, J., said: "It is a general rule of law that a person cannot be convicted and punished in a proceeding of a criminal nature unless it can be shown that he had a guilty mind. . . . . It is said that the respondent is liable because he, in fact, used this furnace for the purposes of his trade. I agree that he used it, for I entertain no doubt that if this were a civil proceeding for damages he would be liable, and yet he could in such proceeding only be liable if he were the person using it. . . . . The essence of the offence is that it should be negligent, and here the respondent took all the care he could."

We now come to the most important section of all, namely, Sec. 24 of the Public Health (London) Act, 1891, which is identical with Sec. 91 (7) of the Public Health Act, 1875. It is there provided that any fireplace or furnace which does not, as far as practicable, consume the smoke arising from the combustible used therein, and which is used for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse or gasworks, or in any manufacturing or trade process whatsoever, and any chimney (not being the chimney of a private dwelling house) sending forth black smoke in such quantity as to be a nuisance, shall be deemed to be a nuisance liable to be dealt with summarily in manner provided by this Act; provided . . . . that where a person is summoned before any Court in respect of a nuisance arising from a fireplace or furnace which does not consume its own smoke . . . . the Court shall hold that no nuisance is created within the meaning of this Act if it is satisfied that such fireplace or furnace is constructed in such manner as to consume as far as practicable, having regard to the nature of the manufacture or trade, all smoke arising therefrom, and that such fireplace or furnace has been carefully attended to by the person having the charge thereof.

Many points of law have occurred in connection with this statute, but the questions arising have been settled by the judges of the High Court. In Patterson *v.* Chamber Colliery Company (56 J.P., 200), it was decided that coal mines come within the list of industries expressly enumerated, and therefore any undue emission of smoke from the works connected with a coal mine may form the subject matter of a prosecution.

It should be noticed that the above section is divided into two parts, (1) that part which makes it an offence to have a furnace which does not, as far as practicable, consume its own smoke; (2) that part which makes it unlawful to have a chimney sending forth smoke in such quantity as to prove a nuisance. The proviso to the section exempts anyone from liability if the fireplace or furnace is constructed in such a manner as to consume its own smoke as far as practicable. In the case of Weekes *v.* King (1885, 53 L.T., 51) an information was laid against the proprietor of a brewery "for that black smoke was sent forth from the chimney of his brewery in such quantities as to be a nuisance." He was fined and convicted. The Court (consisting of Day and Pollock, J.J.) upheld the conviction, upon the ground that the proviso extended only to the first part of the sub-section, and not to the latter part, making it an offence to send forth black smoke in such a quantity as to be a nuisance. It followed from this that the defendant was not entitled to call evidence as to the construction of the furnace.

The question of the liability of the owner of a mill for the negligence of his servants in causing or allowing the furnace to smoke is one which has given rise to considerable discussion, and upon which the reported cases may appear at first sight to be conflicting. As a general rule, it may be said that a master is not responsible for the criminal acts of his servant, unless he command or personally co-operate in them. Statutory offences, however, are of a quasi criminal nature, and are treated differently. We have seen that, according to the case of Chisholm *v.* Doulton (*ubi supra*), if the offence has been committed owing entirely to the negligence of a servant, the master cannot be held liable under that particular clause of the Act. One of the elements of the offence there created was "negligence," and this word cannot be found in, much less inferred from, the construction of Sec. 24.

Another important case was Niven *v.* Greaves (1890, 54 J.P., 548). There the defendant was owner of a mill which, upon several occasions, sent forth black smoke from its chimney. The furnaces communicating with the chimney were constructed in such manner as to consume their own smoke as far as practicable. The respondents had exercised reasonable and proper supervision over the persons in charge of the furnaces, and the nuisances complained of arose through the neglect of the stokers, and not through that of the respondents or their foreman. Upon the case reaching the Divisional Court, it was held by Coleridge and Fry, L.J.J., that the justices ought to have convicted in spite of the case of Chisholm *v.* Doulton. A distinction appears to have been made from that case on the ground that (*a*) to use a properly-constructed furnace negligently, and (*b*) to allow black smoke to issue from a chimney are two distinct offences, and that whereas the master must be held liable in case (*a*), he cannot be so regarded where the mischief is caused solely by the neglect of his servant.

In R. *v.* Waterhouse and Another (L.R. 7 Q.B., 545) it was decided under the Nuisances Removal Act, 18 and 19 Vict., c. 121, Sec. 12, that each daily emission of smoke was a separate act of disobedience for which a separate summons might be lawfully issued, and that the justices were entitled to inflict fines accordingly.

Upon the authority of Gaskell *v.* Bayley (30 L.T.N. 516), it is not necessary to show for the purposes of procuring a conviction that the issuing of black smoke is injurious to health, as well as a nuisance. That case is also of interest, inasmuch as during the hearing certain bye-laws were discussed containing clauses with regard to what constitutes black smoke and medium smoke. By black smoke is meant such a volume of smoke that an object on the opposite side of the smoke to the spectator could not be perceived. By medium smoke is meant such a volume of smoke that an object on the opposite side could be perceived. It was proved that on five different days during one hour each day black smoke issued from 35 to 54 minutes during the hour, and medium smoke for nearly the whole of the remaining minutes. It was also proved that there was a foreman on the premises, and that the furnace was constructed in a a proper manner, but the conviction was upheld.

We have already alluded to the Towns Improvement Clauses Act, 1847, by Sub-sec. 200—210 of which, the Commissioners were entitled to make bye-laws for the purposes of the Act, including the suppression of smoke nuisances. Such bye-laws may be enforced by the infliction of penalties.

In addition to the statutes above referred to, it will be seen that there are numerous questions of fact, after the investigation of which it becomes the duty of the magistrates to adjudicate upon the merits of each particular case. In determining whether a mill-owner has broken the law, the great unpaid are naturally guided by the general nature of the industries which are carried on in the district, if not by the temperament and hardihood of the inhabitants who may, so to speak, have become acclimatised to the inhalation of an atmosphere laden with a certain quantity of smoky particles and carbonic acid gas. For instance, that which in an agricultural town might constitute an intolerable nuisance, would probably be regarded in Sheffield, or in any other busy manufacturing centre, as a matter of everyday occurrence.

In each case it must be a question of degree.

In the recent case of the South London Electric Supply Corporation *v.* Perrin (which was reported in the *Times* in May, 1901), the complainant alleged that upon ten distinct occasions (specifying them), the appellants had allowed smoke to issue forth in such quantities as to be a nuisance. No witness stated that the black smoke was a nuisance to himself. The Lord Chief Justice, in giving judgment affirming the convictions, said that he must not be thought to say that the magistrate was bound to convict because black smoke issued from the chimney, but, on the other hand, he did not think it was necessary to show that any particular individual or property had been injured. It was impossible for the Court to say that the magistrate was wrong in coming to the conclusion that an offence had been committed.

SOME SUGGESTIONS AS TO ECONOMY.

The following remarks are made by "G. J. A. P." in a recent issue of the *Street Railway Review*:—

"The superintendent of a small road should possess, to a certain extent, a creative mind—one whereby he can put material which would be discarded by larger roads to good use. Among such material are old truck bearings, &c., which can be taken to pieces and rebuilt, and by using various good parts of two or more worn-out trucks, have one good truck. This of course will diminish the number of trucks on hand, but it is cheaper to work them over than to entirely discard them.

"Where brass bearings are used the worn bearings can be turned out and babbitted, so as to make them fit the shafts of armatures, and as these shafts are generally worn down to a considerable extent, new brasses cannot easily be secured, except on special orders; and then it would be almost impossible to get them to fill all the armature shafts, as the wear may not be equal on each one. If a certain size bearing were ordered, it would require the turning down of all the shafts to fit these bearings.

"I have found the most economical method under these circumstances to be as follows:—Take your old brass bearings and have one eighth of an inch turned out of them, and at the same time have catch holes bored into the shoulders to hold the babbitt in place; then use your armature shaft for the core, putting narrow strips of babbitt metal which have previously been gauged to the right thickness between the brass and the shaft. This gives an exact fit. By suitably warming the brass and shaft, when the hot babbitt metal is poured it will unite with these strips and make a very smooth good fitting bearing. It is best to pour each half (upper and lower) bearing for each end of the shaft separately, as this gives you an opportunity of scraping and properly adjusting the bearings to the shaft.

"The same method can be followed with journal and motor axle bearings, as it will be found very cheap and will give excellent results.

"Old trolley wire can be used for bonding purposes, by cutting it into suitable lengths and then using either a bonding cap or

finger clips to secure them to the rails. This makes a very serviceable bond and a corresponding saving in new bond wires.

"Where a line is permitted to furnish power to shops and small factories, a very ready sale at fair prices can be found for old street-car motors, to be used as power motors. It often requires considerable time to get them to work at the proper speed, however, but by either changing the field or armature windings the proper speed can be secured. Often the consumer is satisfied to have the necessary change in speed made by means of countershafting.

"As a small road does not as a rule operate very heavy cars, and the service is not very frequent, the track does not readily get in bad condition, but low joints will come, and splice plates will wear. Sometimes the plates become so worn that they do not help to hold the rails up. To make such joints more permanent, sink two ties—or three, if one tie is directly under the joint—down to a depth of 4 or 6 in. below their normal height, then saw an oak plank of 4 or 6 in. thickness to such a length that it will reach over and rest on these ties. Place this piece under, and lengthwise with the rail and tamp up the ties. This will make a very solid joint out of an otherwise loose and low joint. These pieces can very easily be cut out of old ties which have been removed because either the ends or the centres only are worn out.

"Where broken joints are used it will be necessary to put chair blocks under the rail opposite the joints. In this way you get service out of otherwise useless ties.

"Old poles should not be cut up and burned as frequently happens. These should be properly stored and disposed of for posts, gate supports, &c. It does not speak well for a superintendent's economy to see a broken pole left where it is taken out, only to be hauled away by some person who sees a value in it.

"The use of large, heavy cars in a town or city, where the average riding is not sufficient to more than half fill the capacity of the cars, is a constant loss to the company.

"The writer took charge of a road at one time where 16-ft. 8-ton cars were being operated. The traffic did not require cars of half that size. In the barn, idle, were a number of 10-ft. side seat open trail cars. By cutting down old 6½-ft. base trucks to a 5½-ft. base, and fitting these cars with motors, the line was operated with cars having 15 H.P. single motor equipments, and the service was all that could be desired, while the expense for repairs, power required, &c., was correspondingly reduced. The cost of changing these cars amounted to $21.35 each, the principal item being the cost of changing the trucks.

"These cars were then closed in for winter use, and made very comfortable and serviceable closed cars.

"The old saying is, 'necessity is the mother of invention,' but the superintendent of a small road should not wait for the necessity to arise before inventing, but should be at it constantly, and thereby save a penny whenever it is possible to do so."

IMPROVED METHOD OF MANUFACTURING COPPER, ETC.

This process, which was invented and patented by the late T. H. Martin, Swansea, consists of utilising the heat resulting from the operation of refining copper, for the purpose of carrying out the rolling in the "breaking-down" and "drawing-on" stages, thus doing away entirely with any reheating in the heating furnaces usually used for these stages in the existing mode of manufacture.

The cakes, plates or bars are laded, as ordinarily, from the refinery furnace into specially constructed tipping or other detachable moulds which have permanent copper plates for their bottoms, the moulds receiving the usual preparation before the plates are laded into them, thus doing away, in the first place, with the thin layer or copper bottom, which is at present first cast into each mould or pot before the cake itself is laded on to it, and resulting in a great saving of labour, fuel and time in the casting and remelting of these layers or bottoms, besides increasing the net yield of the refining furnace.

The cakes, plates or bars, when perfectly set after being laded, are then immediately tipped from their moulds and conducted direct to the breaking-down rolls, through which they are passed several times, and subsequently, after being sheared hot, to the drawing-on rolls, where the rolling is also fully carried out, or to a very large extent. All the rolling up to this stage would be done by means of the heat left in the copper from its original molten condition in the refinery; thus it will be seen that two separate reheatings are obviated and done away with.

After the drawing-on rolling is completed, the sheets, &c., are treated as in the existing process of manufacture They are allowed to cool, sheared to weight, and are then ready for being heated in the finishing furnace preparatory to being rolled in the finishing stage in the finishing rolls, this latter reheating alone being requisite in the new method; but for a large number of products, such as heavy plates, bars, and hoops, even this may be obviated, as they can be finished entirely from the original heat.

Now, in the frequent reheating which is carried on in the old or existing mode, unless great care is exerted, the copper is often overheated and burns in places through irregular heating, and if the men have been very negligent a great portion has to be taken back to the refinery furnace to be remelted and refined afresh. This risk would be entirely avoided in the new process, as the refinery heat would be sufficient to carry it through all the rolling up to the finishing stage.

In the furnaces where such reheating is done much grit, dirt and dust is gathered by the products, causing a great deal of chipping, cleaning, and roughness of surface, which is avoided by the new process. This also does away with the risk of waste and remelting of cakes, &c., in consequence of the charge in the refinery furnace sometimes losing its "tough pitch," which in the new method would be immediately discovered by the roller man at the rolls by the behaviour of a single cake under the rolling stress, in time to afford the refiner opportunity to alter and improve the pitch before other cakes or plates could be laded that were not up to the mark.

Finally, the process would effect a great economy in space for plant, also enabling the machinery and men to vastly augment the yield of the mill, and to execute orders with greater dispatch by doing away with their enforced idleness through waiting for the heating of products in heating furnaces; it has also been shown that there is a great improvement in the finish of the work, the surfaces of the products being much cleaner and having a better appearance.

The process above described is also in its main features applicable to the manufacture of alloys, such as yellow metal, Naval brass, and the like, which require to be rolled hot. With these the metal or mixture, whether melted in furnaces or in pots, is subsequently poured into suitable tipping or detachable moulds in the shape of plates or bars; by the new method they would be immediately stripped from these moulds as soon as they were set, and conveyed without loss of time direct to the rolls, where they would be "broken down," sheared hot, and in most cases "drawn on," and after being allowed to cool would be ready for treatment in the "finishing" stage. All the foregoing would be done by simply utilising the heat contained in the plates after casting and being allowed to set, thus enabling the rolling to be accomplished (excepting only that of the finishing stage) without any reheating whatever; so that a very important saving is effected, as in the case of copper.

By the new process, about 15 cwt. charges of yellow metal have been melted in the usual mixing furnace, tapped into pans, laded thence into kettles, and poured into moulds as plates or bars, and after having set have been taken from their moulds and conducted to the mill, where the twelve plates, say, composing the charge, have been rolled right up to the stage ready to be finished for sheets, and all this has been done in a short space of time averaging less than nine minutes, so that it will at once be seen that the consideration of time alone is of the greatest importance, the yield of any particular mill being greatly increased in consequence; again, the finish of the work and the appearance of the products are much superior to that produced by the present system of rolling.

CURRENT SPECIFICATIONS.

LXXV.—ASTON MANOR ELECTRIC LIGHTING.

Summary.

Extent of Contract.—Provision under separate sections of the whole of the plant required for an electricity supply undertaking at Aston Manor.

System Adopted.—Three-wire direct current system, the balancing dynamos being wound for 250 volts, the larger machines for 500 volts.

Number of Steam Dynamos.—Two low-speed engines directly coupled to 500-KW. dynamos, and one low-speed set to develop 200 KW. as normal working load.

Maximum Speed.—For either size not to exceed 100 revolutions per minute.

Steam Pressure.—190 to 195 lbs. per sq. in., sets to be suitable for working either condensing or non-condensing.

Type.—Engines to be of vertical triple-expansion type, preferably three-crank, all motions being enclosed in dust-proof chambers.

Overload.—Engines to be suitable for working at 15 per cent. overload continuously, or 25 per cent. for short periods.

Superheat.—Steam supplied to engines to be superheated 150° F.

Range of Governing.—Hand adjustment whilst running to extent of 5 per cent. Momentary variation with whole load thrown off not to exceed 5 per cent., or permanent variation 3 per cent.

Dynamo Output.—To be capable of giving 500 KW. or 200 KW. respectively at 500 volts at any load as a compound-wound machine. To be capable of dealing with either traction or lighting load, and to be varied by adjustable resistances at constant speed by steps of 2 volts between 450 and 500 volts.

Permissible Momentary Load.—Sets to work without undue sparking at 750 or 300 KW. respectively or without serious sparking for short periods at 1,000 or 400 KW.

Permissible Temperature Rise.—Not to exeed 70° F. after six hours' full load run, the same temperature rise not to be exceeded after 18 hours' run at varying load, and after one hour's run at 50 per cent. continuous overload not to exceed 100° F. All measurements to be taken thermometrically.

Guaranteed Steam Consumption.—To be stated by tenderers in forms supplied with specification, under pain of rejection of set if exceeded on a six-hour test to be taken after erection on site.

Motor Balancer.—To consist of five machines directly coupled together, centre one 200 KW. motor, each of the other four machines

being a 50 KW. dynamo 250 volts. Set to be arranged so that either pair can be employed to balance the system.

Overload and Speed.—Each machine to be capable of working at 25 per cent. overload, and speed of combination not to exceed 1,000 revolutions per minute.

Specified Date of Completion.—Eight months from date of order.

Penalty for Late Completion.—5 per cent. of contract price per week.

Terms of Payment.—80 per cent. on monthly certificates of engineer of value of work executed and plant delivered on site, 10 per cent. within one month of plant being put in continuous effective usage, 10 per cent. six months later.

Period of Maintenance.—12 months from date of completion.

Stipulations as to Removal of Foreman.—Satisfactory.

Stipulations as to Wages to be paid to Workmen.—Acceptable. Standard rates to be paid.

Sureties.—Two to be found to be joined in a bond up to 25 per cent. of contract price.

Arbitration Proposals.—Acceptable.

Date for Receipt of Tenders.—September 4th, 1901.

The specification, of which the above is a summary of one of the sections, has been prepared by Mr. R. P. Wilson, the consulting engineer to the Urban District Council. From the extracts given it will be seen that great importance is attached to the question of economical production of electrical energy. Not only are triple-expansion engines preferred, and a working pressure of 195 lbs. per square inch specified, but it is also stipulated that the steam engine shall work satisfactorily with steam superheated 150° F. Tenderers are to give with their offers guarantees as to steam consumption per KW.-hour when working both condensing with a 24-in. vacuum and also exhausting to atmosphere, and if these figures are exceeded on test the sets are liable to total rejection.

The maximum specified speed for both the 500-KW. and 200-KW. sets is 100 revolutions per minute, but it is stated that alternative offers for higher speed sets will receive due consideration if accompanied by full particulars.

The motor balancer is of unusual capacity. It is specified to consist of five machines directly coupled together and running at a speed not exceeding 1,000 revolutions per minute. The motor placed in the centre is to be capable of driving, when supplied with current at 500 volts, the four dynamos at 25 per cent. overload. The normal rating of each dynamo is 50 KW., they are wound for 200 volts, and either pair may be used at will, either with the motor in circuit, or, if preferred, without it.

The general conditions are, on the whole, of an acceptable character. The arbitration clause is worded as agreed upon by the Electrical Plant Manufacturers' Association and the Municipal Electrical Association, and the clause relating to wages and hours of labour, simply stipulates for those usual in the district.

There is a slight discrepancy in the clause referring to the power of the engineer to reject materials, when it states that an appeal from his decision to arbitration can only be made if notice be given within 36 hours, whereas in the arbitration clause itself, *any* dispute may be so referred if notice is given within 72 hours.

The specified period of free maintenance against faults due to defective workmanship or material is stated to be one year from date of completion of contract, and for the cable section of the contract *ten* years. It will be necessary for due allowance to be made for this when tendering, and we recommend that all tenderers, when making up their offers, carefully read this clause, in order to see whether they can accept it without slightly modifying the wording. The penalty demanded for late completion of the work is excessive. For the steam dynamo section it is not less than 5 per cent. of contract sum per week.

It is true that the contract sum for this section is divided up into three parts, viz., for the 500-KW. engines and accessories, the 500-KW. dynamos and accessories, and the 200-KW. steam dynamo, motor balancer and accessories, but it is stated that other things being equal, preference would be given to a tenderer offering 500 KW. steam dynamos complete, when presumably the price for these two sections at least would be given as a lump sum. It will be remembered that the maximum percentage penalty mentioned in the model clauses referred to above as agreed upon by representatives of manufacturers and municipal engineers was *one* per cent. of contract sum per week, and we strongly recommend tenderers to adhere to this amount, and refuse to accept the *five* per cent. stipulated for unless there is a corresponding bonus given for earlier completion than the eight months mentioned in the specification.

THE LEGISLATION OF THE SESSION.

By our Parliamentary Representative.

Although a number of Bills still await the Royal Assent, the real work of the Parliamentary session is over, and one is enabled to take stock of what has been accomplished. It has become the fashion for certain journals to be ever harping upon the backwardness of England in electrical enterprise. However true this might have been in the past, ample evidence has been afforded this session that professional men, capitalists, and corporations are now fully alive to the importance of being abreast of the times, and if the schemes which have been sanctioned are carried to maturity, the result will be the investment of an enormous capital in electrical undertakings in the near future. The reports which have been given week by week in the Electrical Review afford practically a complete account of the work of the session so far as electrical matters are concerned, although perhaps here and there a Corporation Bill, authorising slight powers with respect to tramways or electric light may have been overlooked. Excluding the eight tube railway Bills which were referred to a Joint Committee, and have been shelved till next year, 52 ordinary Bills, four tramway provisional order confirmation Bills, and 12 electric light provisional order confirmation Bills have been dealt with in these columns. The four tramway order Bills confirmed orders granted by the Board of Trade in 23 different districts, and the 12 electric light provisional order Bills confirmed orders granted in no fewer than 93 districts.

In the promotion of these Bills alone an enormous amount of money has been spent, and in this connection it is impossible to shut one's eyes to the fact that a great deal of waste might be avoided. Under the present procedure a group of Bills is referred to a Committee, and often hundreds of witnesses are kept hanging about the rooms and corridors for days before being called upon. Then, when the Bill has passed one House, the same procedure is followed in the next House, and witnesses whose evidence has all been officially reported are examined for hours on identically the same points. This has been notably instanced this session in the case of the Manchester and Liverpool Express Railway Bill, which was bitterly opposed in both Houses and took several weeks in the hearing.

The Liverpool and Manchester Express Railway Bill is perhaps the most important Bill passed this session. It is true that experts have differed greatly as to the practicability of carrying out the scheme, but at all events it shows a departure from the conservatism of Parliament that the experiment of the mono-rail should be allowed to be tried, and undoubtedly the result of Parliament giving its consent will be that many similar schemes will be brought forward before long. Already it is hinted that next session will see proposals for a mono-railway between London and Brighton.

So far as London is concerned, the greatest interest has been evinced in the eight tube electrical railways proposed. These were all referred to a Joint Committee, presided over by Lord Windsor, with a view to deciding which were the best for the public. The Committee found its task harder probably than it expected, and could not get its work completed in time to allow of a final report.

It is not unlikely that next year will see proposals brought forward by the Great Eastern Railway for deep-level electric lines under their present lines, for these were frequently mentioned before the Committee.

Notwithstanding the shelving of tube railways, great progress has been made towards improving the means of getting through and out of the metropolis. The Tramway Bill of the London County Council has been passed in the main, and this will enable the Council to greatly extend the tramways they now possess, and which they are on the eve of converting for electric traction. The forward policy of the Council has been checked in more than one instance by the refusal of the Metropolitan Borough Councils to give their sanction, and this has led to the Council's adoption of the policy of making grants for street improvements conditional on consent being given for the construction of tramways. Anyone who has watched the proceedings before Parliamentary Committees knows that about the greatest difficulty a private company or individual promoting a tramway scheme has is to make terms with the local authorities to get their consent, and in nine cases out of ten the local authority manages to bleed the promoters pretty well.

The London County Council has by no means been guiltless of trying to extract its pound of flesh when its consent is necessary, and it would seem that some of the new Borough Councils have learned something from the larger municipality. Perhaps the most glaring instance which has been afforded this session of the "bleeding" of a company by local authorities is that of the London United Tramways Company. This company has had to pay a pretty figure for the privilege of running through several of the Surrey towns and villages. However, the company has been successful in

having several very important extensions authorised, which will, no doubt, be a source of profit to it, as well as an immense boon to the people of London. The Bexley Tramways Company has also been authorised to construct a number of lines coming up to the county boundary which will eventually connect with the London County Council's system. A highly important development is the intention to electrify the Metropolitan District Railway and the Metropolitan Railway, but the Board of Trade will in all probability have to settle the system to be adopted. The proposal to construct tramways at Hendon and Finchley was thrown out by the Lords.

Very little has been done in the way of lighting for London during the session. The long standing dispute as to the lighting of Marylebone has been settled by an order being granted to the local council, which has made terms with the Metropolitan Electric Lighting Company. The Lewisham and District Electric Supply Company has secured orders to light both Lewisham and Penge. The Metropolitan Electric Supply Company has got its Bill through, giving powers with regard to trunk mains, and no opposition was offered to the Bill of the Notting Hill Electric Light Company for the acquisition of lines, &c.

As was to be expected after the decisions of last session, some very important electric power Bills were brought forward. They were the Caledonian Bill, with a suggested area of supply of 1,135 sq. miles; the Clyde Valley Bill for 730 sq. miles; the Cleveland and Durham Bill for 820 sq. miles; the Yorkshire Bill for 1,800 sq. miles; the South Yorkshire Bill; the Derbyshire and Nottingham Bill for 1,570 sq. miles; the Shannon Water-Power Bill, and the Loch Leven Water-Power Bill. The result of the proceedings before Committee was, that the Caledonian Bill was thrown out, the South Yorkshire Bill was absorbed by the Yorkshire Bill promoters, and all the other Bills were passed. There was no fight, as in last session, over the question of the economy effected by the generation of electricity on a large scale and its subsequent distribution, but there was just the same opposition from local authorities, with the result that, as in the Bill last year, all the big cities were successful in getting excluded from the areas scheduled.

An interesting Bill which passed almost unnoticed is that of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, which is the first attempt of a number of local authorities to co-operate together to supply themselves with electric energy.

Owing to the new Private Legislation Procedure (Scotland) Act, which provides for local inquiries being held in the case of opposed Scotch tramway Bills, the work in the committee rooms was considerably lightened this session, but in the early part of the year an important decision was given by the Chairman of Committees in the case of Paisley tramways when he allowed Standing Orders to be dispensed with, and permitted the Bill to proceed notwithstanding that consent of local authorities over two-thirds of the route had not been obtained. Some big tramway schemes have been sanctioned. By the passing of the South Lancashire Tramway Company's Bill it will be possible, when the tramways are constructed and joined up to those now existing belonging to the company and other people, to go from Manchester to Liverpool by tramway. The Birmingham Tramways Bill is interesting, as it is an important step in the direction of running all the tramways in that city by electric traction; at present there are four different systems of traction. The Dublin Tramways Bill is also interesting inasmuch as the tramways concerned in the Bill are all in connection with Guinness's Brewery, and power is taken to use mechanical traction. By the West Cumberland Bill 31 miles of tramway will be constructed which will join up several "coming" watering places. The Lowestoft Bill provides for tramways to run right through that town and join up with a light railway. Bills affecting the tramways in Manchester, Blackpool, Tyneside, Gateshead and district, Leeds, Bolton, Watford, Sheffield, &c., have also been passed.

On the whole there has been comparatively little conflict of expert opinion, but several decisions have been given which will probably have a bearing on future Bills. In the early part of the session a clause was inserted in the Sheffield Corporation Bill giving the Sheffield Gas Company more protection with respect to electrolysis than that afforded by the model clause of the Board of Trade, and attempts were made to get a similar clause inserted with regard to the other Bills. The real fight took place on the London United Tramway Company's Bill, and a large number of expert witnesses were called on either side, their opinions being set forth at considerable length in the Electrical Review at the time. In the end the Committee refused to give further protection than that afforded by the Board of Trade clause. This decision was followed by other committees, and it will probably go far to discourage the opposition of gas and water companies to tramway schemes. Following on the unfortunate occurrences at Liverpool when the telephone wires were blown down and got entangled with the overhead wires of the electric tramways, the National Telephone Company brought forward a clause excluding them from any liability from any escape of electric current from tramway wires, unless it be proved that such escape is due to the default of the Telephone Company. This clause they got inserted in the Tyneside and several other Bills. The only other point of considerable importance was that raised by the Lancashire Power Company, who objected to the South Lancashire Tramways Company being allowed to supply energy in bulk to local authorities making application. The Committee passed over the objection, and thereby decided that the principle of competition contained in the Electric Lighting Acts applied to power companies equally with ordinary electric lighting companies.

MODERN SYSTEMS FOR SHOP WORK.

By W. H. BOOTH.

Not many years ago the outfit of the English working engineer consisted of little else than a pair of calipers and a foot rule. The rule was rarely graduated beyond 32nds of an inch. Occasionally a short bit of it might contain divisions of $\frac{1}{64}$th in., but anything finer than these divisions was approximated by the use of terms such as full and bare. In spite of this paucity and roughness of measurement the work done was good. It was sound work, it was mechanically good, but it was bad from a manufacturing point of view, in that it was not interchangeable and was not cheaply manufactured. In this old-fashioned style of work no gauges were employed. Pieces were turned as nearly to a given size as the calipers could be set to the size on a rule, and any piece having been turned or bored, the piece to fit or to work with it was made by setting the calipers to the already machined part, and completing the unfinished piece to the calipers with such allowance as was necessary for oil, &c., such allowance depending upon the judgment of the workman.

Workmen then were skilled men. The proportion of skilled men is less to-day, but as handicraftsmen there are still many left in this country, far more than are to be found, say, in America. There are skilled machinists in America, men brought up to do fine work with machine tools, but not of much account as handicraftsmen. An American will positively deny that good work can be turned out of many of the old-fashioned English shops which we all know to be doing good work. These American unbelievers quite overlook the fact that they have crossed the Atlantic many times in perfect trust of the very British work they affect to condemn, and that sounder work than any to be found elsewhere may be seen any day on British ships in New York Harbour. It seems to us probable that in so loudly decrying British workmanship, Americans have done much to harden the hearts of British manufacturing engineers against new methods. They know that it is untrue to say British workmanship is bad, for to-day there is no work better either in material or workmanship, and no American productions in engineering come up to it.

But there are respects in which the British work is wrong. It is not interchangeable, and it costs too much. It might be made comparatively interchangeable by using standard gauges to which to set calipers, in place of using the common

rule and setting to sight. Such a system of standards for diameters and lengths of one piece, to which the other piece is afterwards made a good fit, will be a step in advance. The system of standard gauges, however, does not abolish the necessity for judgment in making fits, and is very little less costly to carry out; but it helps towards a partial interchangeability, and it was the beginning of system. Absolutely interchangeable work may be done by making every piece to a certain gauge. The gauge for a shaft, or for a cylinder, for example, would be made so many thousandths of an inch different from the gauge of the bearing or piston, and each piece is made as absolutely to its gauge as the skill of the workman can make it. The work thus produced will be good, and it will be interchangeable, but it will not be by any means accurate to gauge, though it will not be so far inaccurate as not to be interchangeable. Further, in the endeavour to work absolutely to gauge the work will be inordinately costly. Work cannot be made to gauge on this system at cheap rates. Everyone now knows that accuracy is merely a comparative term. No one can work accurately. James Watt congratulated himself when he had bored a cylinder within about one-sixteenth for fitting his piston block at any point. To-day an engineer will work to half a thousandth of an inch. Good engineers' gauges are guaranteed accurate to $\frac{1}{10000}$ (0·0001) of an inch. A fine measuring machine will measure to ·000001 of an inch, and so we may go on, always inaccurate to some extent. As sensible men, we recognise that everything is inaccurate. This being so, the question then arises, How inaccurate can a machine be made and yet be good? This is the crux of the whole matter, and it underlies the whole question of manufacturing engineering.

There are those who think that in adopting an absolute gauge system they have arrived at the height of mechanical perfection.

They still labour under the mistaken idea that absolute accuracy can be attained, and by striving after the impossible they miss the reality. They are at the mercy of as many separate and distinct individual idiosyncrasies as they have men in their shops, and their product is inordinately costly. Now, what is wanted is a system which, recognising that absolute accuracy cannot be attained, seeks to know how far work may be inaccurate, and yet be good work. On this basis is founded the limit-gauge system of working.

A limit gauge is a double gauge. One end is larger than the other. Let it be supposed that a number of rods were wanted of about 1 in. diameter. The greatest variation must not exceed ·01 in. between the extreme sizes. Then, if a double-end caliper gauge be made so that one end measures ·995 and the other measures 1·005, and all the rods are rejected which will not enter the large end or which will enter the small end, the remainder will vary by less than 0·01 in.

In workshop practice we find by experience that a certain hole can be bored regularly within an accuracy of 0·0015 in. and that the shaft to run in it can be turned within 0·0006 of a fixed size. We find that the biggest shaft is not too tight in the smallest holes, nor are the smallest shafts too easy a fit in the largest holes, but that all work together, no matter how picked at random. They are, in fact, interchangeable. We have, let us say, determined the maximum inaccuracy that can be allowed. Such being the case, it is now necessary that all work be slightly more accurate than the widest limit, and to secure this end, we now make a double ended gauge whose ends are within the limits of allowable error. If all our work is such, that one end of that limit gauge will go on, or in, our work and the other end will not so go on, or in, then we have produced a shaft, or hole, that is accurate within the limits.

Let us aim at making a 2-in. shaft. We will have a caliper gauge that has one end 2·0004 of an inch and the other end 1·9998. If the 2·0004 end of the gauge will push nicely upon the shaft, we know this is very close to 2 in. diameter, and the small end of the gauge safeguards us against making the shaft too small, because if the small end goes on the piece is rejected.

This is the limit gauge system. By it there is no caliper setting, with all its waste of time and doubtful accuracy and slip. The fixed gauge, with its stiff section of steel and hardened faces, has no slip. It is made accurate within a fine limit itself, and secures work that is less inaccurate than the limits of its own two ends. The skill of the workshop is concentrated once for all in the selection of proper limits for the gauges. Then the workmen simply use the gauges in place of calipers and rule. They quickly become expert in their use, and skilled in finishing work within the allowed limits. The work they produce is not only good and absolutely interchangeable, but it is also cheap. The system is both better and cheaper than either standard or absolute gauge systems. Moreover, it is a system that admits of a wide application.

Thus, with the new system of rough turning work, and finishing it entirely by grinding, the efficiency of the grinding machine will be greatly improved by supplying to it roughed-out work fairly accurate.

To this end there would be limit gauges for roughing-out work. Their range or limit would be less fine than that of a finishing gauge. For example, the nominal 2-in. shaft is to be roughed out to, say, $2\frac{1}{64}$ in. Then the limit gauge for roughing out may vary from $2\frac{1}{64}$ in. by 0·004 in. at each end, and generally the limit range may be coarser as the work is coarser. At every step the principle can be adopted with advantage to cheapness and rapidity of production, from the smithy, where pieces are forged with something to come off, to the grinding room, where finely-ground spindles are ground to a fine finish for precision machinery.

The limit gauge system is a great help to the workman, because he can bend all his energies to doing his work, and he need not worry over fits. With standard or absolute gauges there is always room for a difference of opinion on the excellence of a calipered dimension or the fit of a gauge. There can be no such questions with limit gauges. One end slips over the work. Therefore the work is small enough. The other end will not go on the work. Therefore the work is large enough. Its size is somewhere between two sizes, and somewhere is good work, because the two ends of the gauge have been designed to give good results. A workman's work cannot be questioned. There can be no disputes. Half the trouble of piecework is wiped out, for there can be no question of fits as in absolute gauging. A rough illustration of an interchangeable piece is the common brick. A writer points out that any brick in a lot is taken at random by the bricklayer and it fits. That is to say, there are no bricks so long or so short that the mortar joint does not allow for, and bricks may be passed of right size anywhere from $8\frac{5}{16}$ to $9\frac{1}{16}$ long. It is all a question of degree. The limit of a brick gauge might be $\frac{1}{2}$ in. in inside work, $\frac{1}{8}$ in. in facing bricks, perhaps $\frac{1}{32}$ in. in certain tile work. Limits of ·002 in. in loom parts, and ·0006 in. in a machine tool, whilst yet finer limits are found in scientific instruments. A clear understanding should be had between a difference and a limit. A difference for fit is the difference we choose to make between two pieces that work together. Thus we may elect to make a shaft $\frac{1}{100}$th in. less than its bearing as provision for oil. This is a difference. But we make the shaft, it may be, anywhere from $\frac{2}{1000}$th in. to $\frac{1}{100}$th in. less than its bearing, instead of exactly $\frac{10}{1000}$th in., because, in either case, we get practically what we aimed at. We then call the limit 0·002 in., and make the two ends of the gauge ·002 in. different in size. Pieces gauged may then vary between themselves by nearly ·002 in., but they will all be practically ·01 in. less than their bearings.

Limit gauge working is not bad working. It is rather a scientific and artful recognition of a human factor—of the impossibility of accuracy—of the certainty of inaccuracy. This inaccuracy, being recognised as unavoidable, is kept within bounds, and the limit-gauge system stands pre-eminent as the means of doing good work both cheaply and interchangeably.

Properly organised limit gauge working is easily carried out. All work being interchangeable, every piece bored to a nominal size, will be a driving fit upon a standard hardened and ground arbor. Should any piece not be such a fit it is evidence that a wrongly bored piece has slipped through by error or carelessness. Thus the lathe hand, with his standard arbor, becomes an unconscious inspector, and he refuses to accept such wrongly bored piece. Thus the system is an aid to the early rejection of wasters before expense has been incurred upon them. In unorganised

shops, labour is often expended on pieces that are faulty, and that would be proved faulty by a properly organised system of inspection. The best American shops have done well by organisation. It remains for British manufacturing engineers to superadd the system to the old British qualities of their work. Let them stick a bit to their old-fashioned clumsiness even at the risk of having their productions characterised as lumps of pig iron by American critics.

There is, after all, something in the anvil principle, and an American catalogue now before me claims this as a virtue in the machines described, and even claims that certain parts have been doubled in weight. In fact, Americans are finding out that much of the once so plentiful talk about the minimum of material scientifically applied was so much nonsense, and American products now often closely approximate to English in the quality of clumsiness once so condemned, and generally the Americans are in advance in shop organisation and in machine work whereby production is cheapened. It is on these points, and practically these alone, that there is large room for improvement in Britain.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1901.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, to whom all inquiries should be addressed.

15,804. "Improvements in telephone selecting devices." W. D. Watkins, J. W. Bolster, F. L. Naylor, G. Davies, E. L. Coryelle and R. A. Berry. August 6th. (Complete.)

15,816. "Storage batteries and alarms therefor." R. M. Lloyd. August 6th. (Complete.)

15,817. "Storage battery boxes or jars." R. M. Lloyd. August 6th. (Complete.)

15,818. "Storage batteries and insulation thereof." R. M. Lloyd. August 6th. (Complete.)

15,819. "Storage batteries and ventilation thereof." R. M. Lloyd. August 6th. (Complete.)

15,826. "Improvements in armatures for dynamo-electric machines or motors." J. B. Blood. August 6th. (Complete.)

15,833. "Improvements in or relating to armatures for electric clocks." W. L. Wise. [The Actiengesellschaft "Magneta" (Electrische Uhren ohne Batterie und ohne Contacte), Switzerland.] August 6th.

15,843. "Improvements in electric fans and motors therefor." E. W. Brown. August 6th. (Complete.)

15,876. "Improvements in or relating to electrical storage batteries." J. H. West. August 7th.

15,879. "Improvements in subterranean conductors of electric railways." P. Grams. August 7th.

15,880. "Improvements in surface contact electric railways." The British Thomson-Houston Company, Limited. (E. M. Hewlett, United States.) August 7th. (Complete.)

15,881. "Improvements in surface contact electric railways." The British Thomson-Houston Company, Limited. (W. B. Potter, United States.) August 7th. (Complete.)

15,882. "Improvements in electric brakes." The British Thomson-Houston Company, Limited. (F. E. Case, United States.) August 7th. (Complete.)

15,902. "Electric battery cells, the better construction of, for the removal of deposits." A. O. Jones. August 7th.

15,909. "Improvements in and relating to the electrodes of electrical accumulators." R. W. James. (J. J. Heilmann, France.) August 7th. (Complete.)

15,911. "Electric circuit breakers or cut-outs for electric conductors, cables, and the like." G. Bellange. August 7th.

15,916. "Improvements in and relating to conduits for electric or other cables." J. F. Cummings. August 7th.

15,918. "Special method of electrical distribution for traction." C. Marillier. August 7th.

15,932. "A motive power by gravity and electricity combined." R. Warry. August 8th.

15,934. "Improvements in wheel-guards for electrically or mechanically propelled tramway vehicles." J. H. F. Bale. August 8th.

15,937. "Improvements in wagons for erecting and repairing the overhead conductors employed for electric traction." S. Rawlinson, W. Rawlinson and J. Rawlinson. August 8th.

15,946. "A rectifier for the conversion of alternating electric currents to uni-direction currents." J. Beach. August 8th.

15,995. "Improvements in or connected with electric railways and tramways on the conduit system." J. Carpenter and J. S. Carpenter. August 9th.

16,004. "Improvements in conduits for electric cables and the like." J. Place & Sons, Ltd., and W. H. Place. August 9th.

16,042. "Improved electricity meter for current strength." O. Imray. (The firm of Hartmann & Braun, Germany.) August 9th.

16,052. "Improvements in an automatic electric-circuit-closing device." G. Rapprich. August 9th.

16,062. "Improvements in electric sparking devices for internal combustion engines." F. R. Simms and R. Bosch. August 9th. (Complete.)

16,072. "Improvements in or connected with electric accumulators or storage batteries." M. Daseking and A. Brandes. August 9th.

16,076. "Improvements in trolleys for electric cars." W. Clayton. August 10th.

16,115. "Improvements relating to electric transformers." R. Grisson. August 10th.

16,121. "Improvements in electricity meters." G. Hookham. August 10th.

16,122. "Working zinc and substances containing silicic acid in electric furnaces." A. Dorsemagen. August 10th.

16,128. "Improvements in electric accumulator batteries." A. Tribelhorn. August 10th. (Complete.)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, Manchester and Birmingham, price, post free, 9d. (in stamps).

1899.

17,262. "Arrangement of connections and conductors for railways worked by electricity." G. Winter and E. Futter. Dated August 28th, 1899. Electric railways and tramways with overhead or other conductors. Conductors.—The conductors and connections are arranged at starting-places, crossings, &c., which are accessible to the public so that the vehicles are supplied with current at a lower tension than on other parts of the line. 4 claims.

17,510. "Improvements in electricity meters." W. C. Johnson and T. J. Murday. Dated August 29th, 1899. Relates to energy meters.—An integrating meter such as is described in Specification No. 12,390, A.D. 1896, is provided with a watt-meter and with a switch for closing the pressure circuit of the watt-meter only when its pointer is free to move, in order to reduce the energy used in this circuit. 3 claims.

17,707. "Improvements in and relating to electric incandescent lamps." W. I. Feony. (Allgemeine Elektricitats Gesellschaft.) Dated September 1st, 1899. Several rods or tubes, or other bodies of material of high resistance at ordinary temperatures are connected in parallel with one another, and the group is connected in series with iron wire or other resistance sufficient to steady the current taken by one rod from a supply at constant pressure. The lamp is started by coils heating all the rods so that they become conductive, but the series resistance then keeps the pressure applied to the rods so low that all become cold except the hottest one, which becomes incandescent. When a rod is worn out another comes into operation, each rod in the group thus acting successively. The rods are fixed so far apart that one cannot heat another. 1 claim.

17,715. "Improvements in appliances for cutting off the current from electric elevator motors and for arresting the fall of the car." J. H. Johnson and W. R. Weeks Dated September 1st, 1899. Lifts; safety suspending or retaining apparatus.—Relates to means (1) for automatically or by hand operating a cut-out switch in an electric lift when the speed becomes excessive or when the cage is raised too high; and (2) for arresting the cage by hand or automatically when the lifting-rope breaks or when other similar accidents happen. 4 claims.

17,719. "Improvements in or connected with variable rate electric meters." J. G. Lorrain. (W. A. Macdonald). Dated September 1st, 1899. Relates to energy and quantity meters. 16 claims.

17,774. "Improvements in ammeters." W. C. Johnson and T. J. Murday. Dated September 2nd, 1899. Relates to current meters. 3 claims.

17,786. "Improvements in electric telegraph apparatus." S. G. Brown. Dated September 2nd, 1899. Relates to translating or receiving telegraph apparatus in which the periods of + and − currents received in submarine telegraphy are broken up into their initial impulses for retransmission either directly with or without curb currents, or by means of a perforated strip, the strip being the form in which the message is received. 8 claims.

17,815. "Improvements in direct-acting electric generators and in directly driven electric compressors for air or other gas." J. Atkinson. Dated September 4th, 1899. Relates to reciprocating electric generators actuated directly by steam and other fluid pressure engines, which may also be used reversely as electrically actuated air and gas compressors. The invention is particularly described with reference to an electric generator. 9 claims.

17,938. "Electro-medical appliances." C. J. Marius. Dated September 5th, 1899. Relates to the insulating core of a massage roller. 8 claims.

17,939. "Improvements in electric rock drills." G. Barker. (S. Lesom.) Dated September 5th, 1899. Rock drills of the type in which the drill is struck by a hammer which is worked by gearing from a rotary electric motor. 8 claims.

17,953. "Improved means and appliances connected with air-tight electric arc lamps." J. J. Rathbone. Dated September 5th, 1899. Arc lamps.—An enclosed arc solenoid lamp has a vertical tube in the lower part of which a split iron socket carrying the lower carbon slides, and the upper part of which is surrounded by a shunt coil to hold up the socket. The tube and socket are connected electrically by a flexible wire or chain or by mercury; when mercury is used, the lower part of the socket is made with a small tapered slot to allow mercury to enter it, its movements being thus retarded. The tube and coil are surrounded by a casing, and the tube supports a glass or other globe, the upper end of which carries a collar and a screw plug holding the upper carbon, the joints being made air-tight. 2 claims.

18,005. "Improvements in secondary galvanic batteries or accumulators." R. H. N. Lucas. Dated September 6th, 1899. Relates to the negatived electrodes, and consists in making them of copper, or of an alloy of copper, in the form of gauze or of a perforated plate, which is immersed in a dilute acid until it has been strongly attacked, after which it is immersed in a strong solution of a mercury salt until it is well coated and is then removed, washed, and immersed in metallic mercury, or metallic mercury may be rubbed into it. If an acid solution of a mercury salt is used, the preliminary acid bath may be dispensed with. The plate is then formed electrically in a bath of a solution of pure zinc sulphate, so that metallic zinc is deposited upon it. A lead lug is burnt on to the copper plate to serve as a connection. 2 claims.

18,040. "Improvements in or relating to telephone speaking tube, and like receivers." H. A. Cutmore. Dated September 6th, 1899. Ear pieces for telephone receivers, speaking tubes, and the like are formed in two parts. One part fits over the telephone, and has a diaphragm with central opening. The other part springs over the edge of the first part, and centrally engages with the edge of the opening in the other part, a metal conical piece acting to hold the parts rigidly together. 3 claims.

18,064. "Improvements in electric trolley standards." C. W. G. Little. Dated September 7th, 1899. Electric railways and tramways with overhead conductors. To permit the cap of a trolley standard to make a convenient number of revolutions in either direction, and to stop any further revolution in order to prevent excessive twisting in the cable in the standard one or more loose collars or rings are provided with projecting stops to engage each other and fixed stops on the cap and standard. The collars may be variously disposed. 1 claim.

18,132. "Improvements in clocks, more particularly in electric winding mechanism therefor." F. J. Getty. Dated September 1st, 1899. Electric clocks; maintaining power. A movement controlled by a pendulum is driven by a pair of weighted ratchet levers bearing pawls, which act on ratchet wheels. The levers are alternately lifted by an electro-magnet, having a lever armature which is connected by a link to a pin engaging on discs on the hubs of the levers. These discs are cams, which alternately mask the ratchet wheels, and similarly let fall a circuit-closing arm. The gravity levers are thrown up against a pivoted padded stop. 7 claims.

22,807. "Improved manufacture of lead peroxide and its application to electrical storage batteries." Dr. H. Beckmann. Dated November 15th, 1899. Relates to the manufacture of lead peroxide, particularly as a coating for the electrodes of storage batteries, and consists in forming the peroxide by using lead as the positive electrode in a solution of free sulphuric acid through which an electric current is passed. 3 claims.